# BRIEF REPORT: COVID-19 EPIDEMIC TRENDS AND PROJECTIONS IN OREGON

***Results as of 8/19/2020 – 11am***

## ACKNOWLEDGEMENTS

This is an update to the Oregon Health Authority's (OHA's) previous modeling reports. This report was based on Covasim modeling software, developed by the Institute for Disease Modeling (IDM). IDM provided OHA with initial programming scripts for the models and has provided extensive support and technical assistance to OHA. OHA especially wishes to thank Cliff Kerr, Katherine Rosenfeld, Brittany Hagedorn, Dina Mistry, Daniel Klein, Assaf Oron, Prashanth Selvaraj, Jen Schripsema, and Roy Burstein at IDM for their support.

## RESULTS UPDATED BIWEEKLY

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 are updated biweekly as more data become available, the science to inform the model assumptions expands, and modeling methods continue to be refined. While these results can be used to understand the potential effects of different scenarios, it is important to note that the 80% forecast intervals for estimates are wide, so point estimates should be interpreted with caution.

## KEY FINDINGS

### Changes after Oregon has begun to reopen

- Based on data through August 13, the model is consistent with a transmission increase of 10 percentage points after May 1, followed by 5 percentage point increases after both May 15 and May 21.
- These increases were followed by transmission decreases of 5 percentage points after June 27 and July 4.
- The current effective reproduction number (Re) – the expected number of secondary cases that a single case generates – is estimated to be 1.0.
- It takes an estimated 12 days on average from when a person becomes infected until they develop severe disease; therefore, it is unclear from hospitalization or death data if transmission changed in August. Recent diagnosis data does not, by itself, indicate a change in transmission.

### Future scenarios

We modeled three future scenarios with different assumptions about transmission levels starting August 14 and continuing over the next month.

- Transmission continues as-is: If we assume transmission continues at the current level over the next month, the estimated number of new daily infections (approximately 900) remains steady over the next 4 weeks. The number of existing infections that are newly diagnosed each day (i.e., newly diagnosed cases) also remains steady, assuming current testing practices continue. The number of new severe cases continues at approximately 19 per day. The model projects 130,800 cumulative infections by September 10. The Re is projected to remain at 1.0.

- Transmission decreases: If we assume that transmission decreases by 10 percentage points and continues at that level over the next month, the estimated daily number of new infections and newly diagnosed cases decreases over time. Compared to the continued as-is scenario, the model projects approximately 12,700 fewer cumulative infections (118,100 vs. 130,800), 600 fewer new infections per day (300 vs. 900), and 8 fewer new severe cases per day (11 vs. 19) by September 10. The Re is estimated to decrease to 0.75.

- Transmission increases: If we assume that transmission increases by 10 percentage points and continues at that level over the next month, the estimated daily number of new infections and newly diagnosed cases increases. Compared to the continued as-is scenario, the model projects approximately 17,600 more cumulative infections (148,400 vs. 130,800), 1,300 more new infections per day (2,200 vs. 900), and 10 more new severe cases per day (29 vs. 19) by September 10. The Re is estimated to be 1.25.

Each of these scenarios is based on different assumptions, as indicated above. The "transmission continues as-is" scenario most closely resembles a forecast. The two other scenarios assume a 10 percentage point change in either direction. Please note that the choice of 10 percentage points is somewhat arbitrary; the scenarios are meant to illustrate the effect of changing transmission on COVID-19 trends and should not be interpreted as a forecast range.

### Conclusions

The results suggest that transmission increased substantially during May, then decreased somewhat in late-June and early-July. Our model estimates the Re is currently about 1.0. If transmission remains at current levels, we expect a steady number of new infections; however, a transmission reduction of 10 percentage points is projected to decrease growth.

## PURPOSE OF THIS REPORT

This report describes trends in COVID-19 since Oregon began to re-open, 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) available at the OHA COVID-19 webpage.

## METHODS

This report presents analyses conducted using methods consistent with the previous August 7, 2020 report, with some key updates:

- Newer data from Orpheus on COVID-19 cases (Orpheus description) were used. Orpheus – the communicable disease reporting system for Oregon -- has a new module being used for COVID-19 named Opera (Oregon Pandemic Emergency Response Application). The Opera data file for this report was obtained on August 17, but data after August 13 were considered incomplete because of lags in reporting and were not used.
- We added a scenario plot estimating the number of existing infections that are newly diagnosed each day (i.e., newly diagnosed cases), assuming current testing practices continue.
- We added information to the methods in the Appendix, comparing the model estimates of number of infections to seroprevalence estimates from a recent study in Oregon.

More information about the methods is in Appendix 1.

## INTERVENTIONS

Oregon has implemented numerous measures to slow the transmission of COVID-19. Since the beginning of the epidemic in Oregon, the state and local public health system has:

- Implemented educational campaigns to increase public awareness about the epidemic and to encourage adherence to guidance.
- Gathered and reported data, as part of public health surveillance, to inform interventions.
- Collaborated with the health care systems, local public health, and other sectors (e.g., education).
- Conducted outbreak investigations and implemented control measures to prevent future outbreaks in similar settings (e.g., congregate settings, workplaces).
- Collaborated with the federal government and health systems to expand access to key supplies (e.g., personal protective equipment (PPE), testing, and medications).
- Routinely investigated diagnosed cases, asked those cases to identify their close contacts, and then notified those contacts of their exposure (i.e., contact tracing). Because of limited public health resources in Oregon early in the epidemic, public health staff had only been able to actively follow up with contacts in households and congregate settings. Contact tracing efforts expanded starting with reopening plans, as mentioned below. Contacts have been asked to voluntarily stay in quarantine for 14 days after their last known exposure. Any diagnosed cases were originally asked to voluntarily isolate for at least 72 hours after symptoms resolve, but this changed over time: they are now asked to voluntarily isolate for at least 10 days after diagnosis or 24 hours after symptoms resolve, whichever is longer.

Below, we list dates of specific interventions.

**Before Reopening**

- On March 8, 2020: Governor Brown declared an emergency due to the public health threat.
- On March 12, 2020: A large number of measures were put in place, such as bans on gatherings of more than 25 people, as detailed here.
- On March 16, 2020: Schools were closed statewide, as detailed here. Further measures were put in place on March 16 and 17, including the closure of restaurants and bars and gatherings of more than 25 people, as detailed here.
- On March 19, 2020: Non-urgent health care procedures were suspended to conserve personal protective equipment and hospital beds.
- On March 23, 2020: Aggressive interventions, namely the "Stay Home, Save Lives" recommendations, were put in place.
- On April 21, 2020: Testing guidelines were revised to allow for expanded testing, including testing of people who are asymptomatic and work in care settings or live in

congregate settings; they were refined on May 1, 2020 and again on June 2, 2020 (Revised testing guidelines).

**Reopening**

On May 1, 2020, Oregon announced plans for phased relaxation of community mitigation strategies, with additional expansion of testing and contact tracing to keep transmission low (Reopening Plans May 1, 2020). Some key changes have included:

- On May 1, 2020: Certain elective and non-urgent medical procedures resumed (Medical Procedures May 1, 2020).
- On May 2, 2020: The widespread use of face coverings was encouraged.
- On May 5, 2020: Some parks, outdoor recreation facilities, and areas across Oregon were opened for day use (Parks May 5, 2020).
- On May 7, 2020: Governor Brown published detailed guidance on reopening. This included requirements for counties to reopen, such as having sufficient capacity for testing and contact tracing. The guidance also called for the widespread public use of face coverings, maintaining physical distance of six feet between individuals as much as possible, and following good hygiene and disinfection practices (Reopening Guidance May 7, 2020).
- On May 15, 2020: Some counties began to reopen, and certain restrictions were eased statewide, such as allowing social gatherings of under 10 people and cultural/civic/faith gatherings of up to 25 people with physical distancing, as detailed here and here). Briefly:
    - On May 15, 31 of the 36 counties in Oregon had been approved for Phase 1 of reopening.
    - By June 1, 35 counties were approved for Phase 1 reopening. The most populous county (Multnomah) had not yet reopened.
    - On June 5 and 6, 28 counties were approved for Phase 2 reopening, as well as one more on June 8.
    - On June 11, due to a rise in COVID-19 cases, the Governor temporarily halted approvals for additional phased reopening.
    - On June 17, the Governor approved Multnomah County's plan for Phase 1 reopening, starting on Friday, June 19.
- On June 23, 2020: An update on the expansion of contact tracing efforts was issued here, reporting about 600 county and state contact tracers.
- On June 24, 2020: Implementation began of a new plan for testing at long-term care facilities, as described here.
- On June 25, 2020: The Governor required people living in Oregon's seven most populous counties to wear a face covering when in indoor public spaces, with some exceptions (e.g., young children, people with disabilities, while eating), as described here. This requirement extended to all Oregon counties on July 1.

- On July 15, 2020: Face coverings became required outdoors in situations where people are unable to maintain a distance of at least six feet from others, and most indoor gatherings of more than 10 people were not allowed, as described here.
- On July 23, 2020: OHA announced grants to more than 170 community-based organizations (CBOs) to help respond to COVID-19 in culturally- and linguistically-responsive ways. Their work will include outreach and community engagement; contact tracing together with local public health authorities; and providing people with social services/wraparound supports, as described here.
- On July 24, 2020: Face coverings were required for exercising indoors, and they became required for all children over 4 years old. Capacity limit for restaurants, gyms, venues was reduced to 100. Bars and restaurants were required to close at 10pm, as described here.
- On July 31, 2020: Morrow County returned to Phase 1, and Umatilla County returned to Baseline/Stay Home because of increases in cases, as described here.
- On August 1, 2020: Governor Brown announced the launch of a new source of financial assistance for agricultural workers who must self-quarantine to slow the spread of COVID-19, as described here.
- On August 17, 2020, Malheur County returned to Phase 1 because of increases in cases, as described here.

### Comprehensive Approach

These interventions continue to evolve as the science expands, we learn about specific community needs, and more funding becomes available. Together, these efforts comprise a comprehensive approach to protect the public's health and wellbeing – with not only direct client services, but also policy implementation, educational campaigns, culturally responsive approaches, support of community action, systems change to address barriers and inequities, and ongoing epidemiologic surveillance and evaluation. As with other comprehensive public health interventions, it is difficult to determine the contribution of any one component because each is essential and they act synergistically; and, in the case of COVID-19, various components were implemented simultaneously or in quick succession.

## RESULTS

As with previous modeling reports, the results in this brief report will be updated as more data become available, the science to inform the model assumptions expands, and modeling methods continue to be refined (see Appendix 2 for information on the limitations). The models simulate the spread of COVID-19 in Oregon statewide under different scenarios. They do not model regional variability, and they do not take into account the complex disease spread or intervention effectiveness within and between specific populations over time, such as for communities of color, workers in certain occupations, or people in congregate settings. The models use average transmission levels; hence they do not, for example, model outbreaks in work settings differently than other types of transmission.

## Epidemiologic trends to date

The model was calibrated (Figure 1) by modifying the assumptions from the literature to best fit data from Opera on confirmed positive COVID-19 diagnoses, number of tests completed, number of severe cases,[1] and deaths for Oregon. The dates on which model transmission levels change were selected based on key policy enactment dates, with the following exceptions based only on data observation: 4/6/2020, 5/1/2020, 5/21/2020 (also corresponding to the Thursday before Memorial Day weekend), 6/27/2020, and 7/4/2020. The degree of changes in transmission were informed by the COVID-19 data, not by the assumed effect of any policy. The model was calibrated to observed data based on the average of 11 randomized runs.

As in previous modeling reports, the calibration provides evidence that Oregon's aggressive interventions -- combined with increased hygiene and other measures that appear to have begun earlier -- dramatically reduced the burden of COVID-19 in Oregon during the spring (Figure 1). Specifically:

- The data are consistent with a stepped reduction in transmission in Oregon, beginning with a 5% decrease in transmission after March 8, up to a maximum 75% decrease in transmission after March 23. Indeed, while the interventions before March 23 appeared to have slowed epidemic growth, the additional aggressive measures implemented on March 23 (i.e., "Stay Home, Save Lives") appeared to have further curtailed that growth. The reductions were likely due to people spending more time at home, as well as an increase in hygiene and disinfection practices, wearing of face coverings, and physical distancing outside the home; however, the data to determine the relative contribution of each change are lacking.
- The data suggest that these dramatic reductions in transmission waned somewhat after early-April, but the number of new daily infections was still declining until early-May.

The current calibration provides evidence that transmission increased substantially during May, then decreased somewhat in late-June and early-July (Figure 1). Specifically:

- New severe cases stopped declining in mid-May before beginning to increase starting early in June. Given the approximate two-week delay between infection and severe symptom onset, both changes are reflective of earlier transmission changes: they are consistent with a 10 percentage point increase in transmission after May 1 and additional 5 percentage point increases in transmission after May 15 (the start of reopening) and May 21 (the Thursday before Memorial Day).
- Transmission appears to have then decreased by 5 percentage points after June 27 and by another 5 percentage points after July 4 -- as reflected by the growth in new severe cases slowing somewhat after early-July. The current effective reproduction

[1] Severe cases include both cases admitted to the hospital and individuals who died but were not hospitalized. Approximately 6% of severe cases are non-hospitalized deaths.

number (Re) – the expected number of secondary cases that a single case generates – is estimated to be approximately 1.0.

- The effects of changes in transmission in August on new severe case numbers may not be apparent until after our August 13 data cutoff, given potential reporting delays and an assumed average of 12 days between people becoming infected and onset of severe symptoms.
- We would expect changes in transmission in August to be reflected in new diagnoses about eight days later, on average (given the time to develop symptoms among those who develop symptoms, and the average time between symptom onset and testing). Daily diagnoses (Figure 1) in late-July are thus far consistent with no July change in transmission, assuming testing practices have stayed the same.

It is important to note that the estimated reductions in transmission over time are imprecise and cannot be attributed to any particular action (e.g., policy or event); some are based on few data points and sometimes multiple actions co-occurred.

The model estimates that, as of August 13, there have been a total of 104,800 cumulative infections in Oregon (80% forecast interval[2]: 73,700 – 128,900), but only 23,200 have been diagnosed according to available data.

[2] "The forecast intervals used correspond to the 10th and 90th percentiles of the simulated trajectories. Although these forecast intervals bear some similarities to confidence or credible intervals, since they are typically produced through a combination of stochastic variability and parameter uncertainty, they do not have a rigorous statistical interpretation." (p 18 of IDM Covasim report)

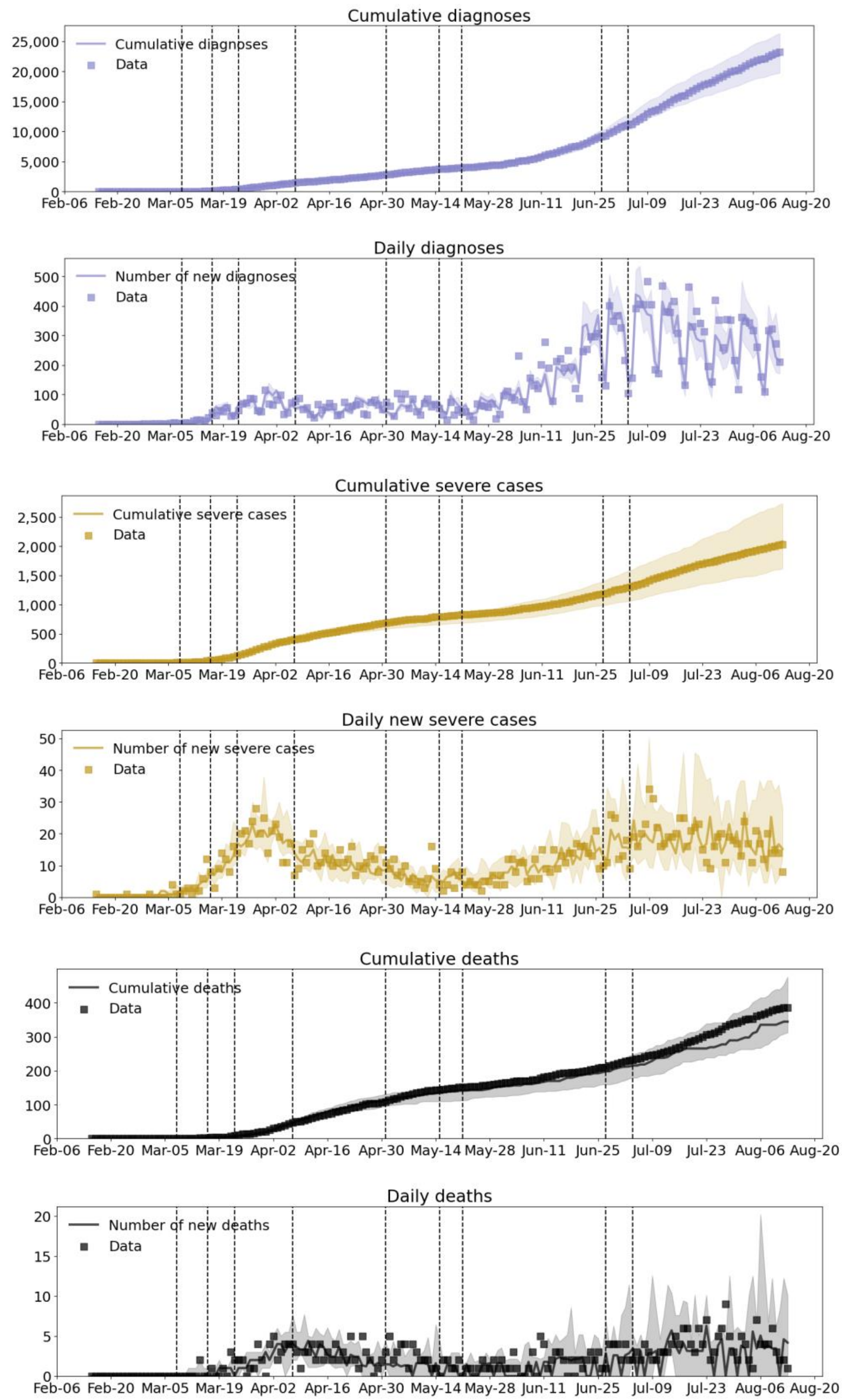


**Figure 1:** Model calibration with Oregon data. Dotted vertical lines correspond, from left to right, to estimated reductions in transmission relative to baseline of 5% (March 8), 50% (March 16), 75% (March 23), 70% (April 7), 60% (May 1), 55% (May 15), 50% (May 21), 55% (June 27), and 60% (July 4). Raw data are presented as squares; estimates from the calibration are presented as lines. The shaded areas represent variability among calibration runs.

## Scenario projections

Because we do not know how adherence to the physical distancing, face covering, hygiene, isolation, and quarantine guidance will change over time, it is not possible to confidently predict future transmission levels. Therefore, we modeled three future scenarios (Figures 2 and 3) through September 10 by making different assumptions about future transmission levels starting August 14. The estimates and forecast intervals are based on results from 11 randomized runs. For all scenarios, we assumed 4,500 tests per day to reflect recent testing levels (August 17 Testing Summary).

- Transmission continues as-is: Transmission continues as-is: If we assume transmission continues at the current level over the next month, the estimated number of new daily infections (approximately 900) remains steady over the next 4 weeks. The number of existing infections that are newly diagnosed each day (i.e., newly diagnosed cases) also remains steady, assuming current testing practices continue. The number of new severe cases continues at approximately 19 per day. The model projects 130,800 cumulative infections by September 10. The Re is projected to remain at 1.0.

- Transmission decreases: If we assume that transmission decreases by 10 percentage points and continues at that level over the next month, the estimated daily number of new infections and newly diagnosed cases decreases over time. Compared to the continued as-is scenario, the model projects approximately 12,700 fewer cumulative infections (118,100 vs. 130,800), 600 fewer new infections per day (300 vs. 900), and 8 fewer new severe cases per day (11 vs. 19) by September 10. The Re is estimated to decrease to 0.75.

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Each of these scenarios is based on different assumptions, as indicated above. The "transmission continues as-is" scenario most closely resembles a forecast. The two other scenarios assume a 10 percentage point change in either direction. Please note that the choice of 10 percentage points is somewhat arbitrary; the scenarios are meant to illustrate the effect of changing transmission on COVID-19 trends and should not be interpreted as a forecast range.

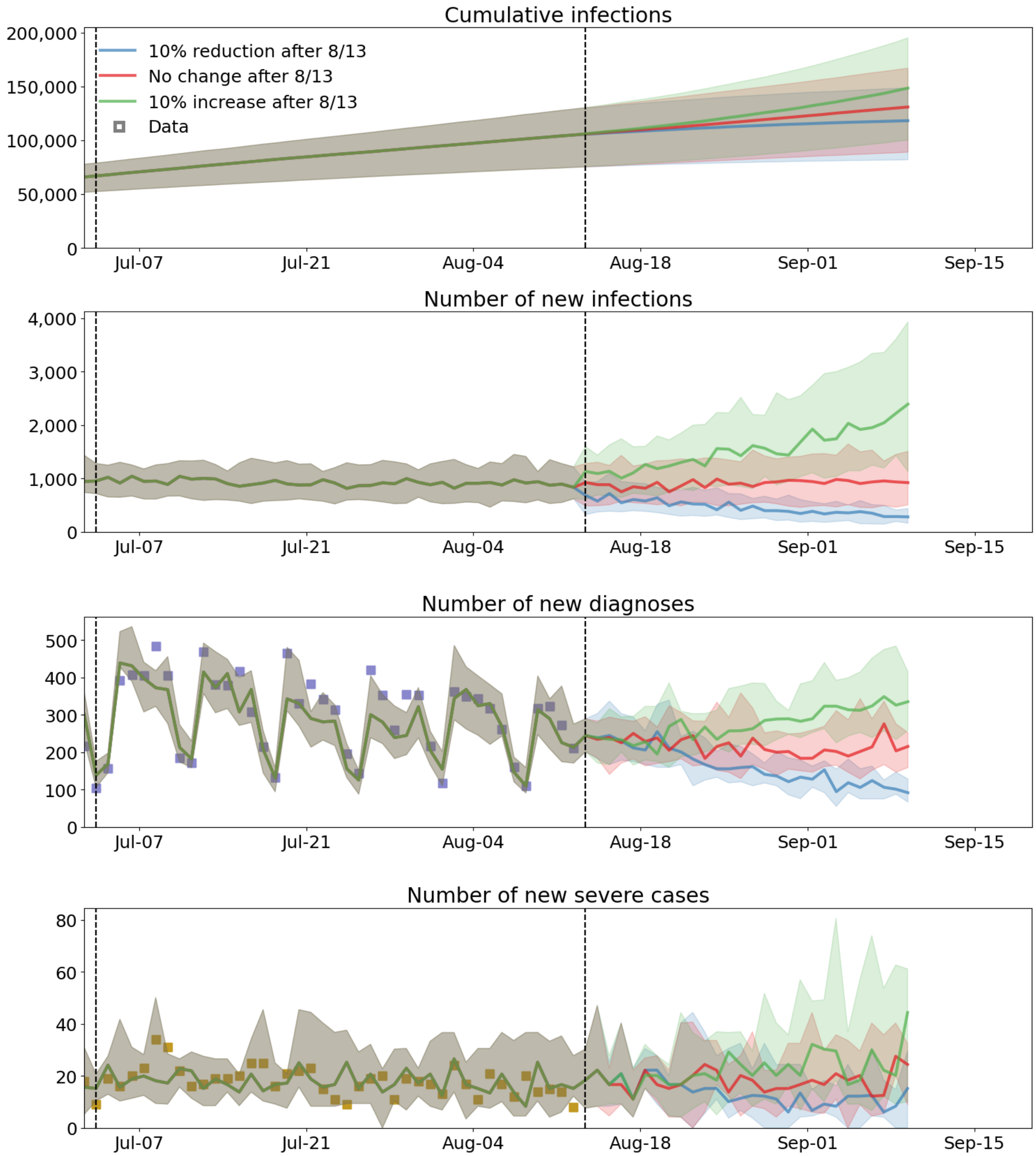


**Figure 2:** Model projections for the next 4 weeks, assuming that after August 13: 1) transmission does not change (red line), 2) transmission decreases by 10 percentage points (blue line), and 3) transmission increases by 10 percentage points (green line). The lighter shaded areas correspond to 80% forecast intervals (i.e., $10^{th}$ and $90^{th}$ percentiles of the projection).

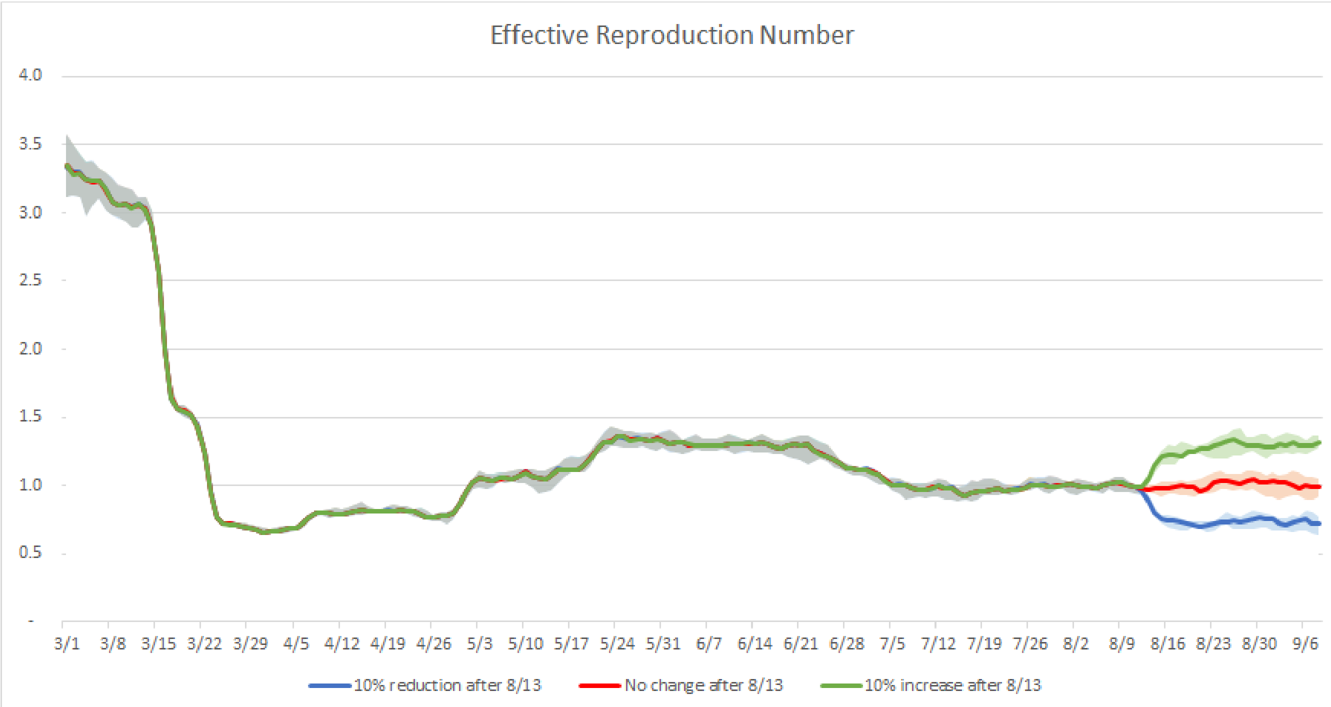


**Figure 3:** Projected effective reproduction number (Re) through September 8, assuming that starting August 14: 1) no change in transmission (red line), 2) transmission decreased by 10 percentage points (blue line), and 3) transmission increased by 10 percentage points (green line). The lighter shaded areas correspond to 80% forecast intervals (i.e., 10th and 90th percentiles of the projection). Re is the expected number of secondary cases that a single case generates.

## Summary of Results

While these results can be used to understand the potential trends in COVID-19 under different scenarios, it is important to note that some of the 80% forecast intervals for these predictions are wide, reflecting their uncertainty.

The results indicate that average statewide transmission increased substantially after reopening, then decreased somewhat. Our model estimates the Re is currently about 1. If transmission remains at current levels, we expect that new infections will continue to occur at an estimated 900 per day. We would expect about 250 of the existing infections would be diagnosed per day while current testing practices continue. This corresponds to about 40 diagnosed cases per 100,000 population each week.

The state's comprehensive approach to controlling this epidemic after reopening and individuals' behavior changes to protect others appear to be reducing our recent transmission levels, but we still have work to do to control this epidemic. First, this model projects statewide averages, but examining disparities is critical to inform interventions. For example, cases are increasing dramatically in some counties (Data dashboard), and the Latinx and other communities of color have been disproportionately impacted (OHA Weekly COVID-19 Report). Second, the scenarios indicate that this infection remains sensitive to changes in transmission, with a relatively small increase in transmission causing a return to exponential growth. Third, the scenarios demonstrate that Oregon needs to reduce transmission further in our community for the daily number of new infections to decline. To achieve this, public health is using a comprehensive approach, as described earlier. Even with testing, treatment, and contract tracing, transmission levels are still dependent on adherence to the guidance regarding physical distancing, face coverings, hygiene, self-quarantining of contacts, and self-isolation of cases. Collaborating with community partners to understand the structural, workplace, social network, and individual-level barriers to adherence to that guidance and addressing those barriers is essential to reducing transmission.

## Comparison with other model results[3]

The latest results from CovidActNow and RT Live estimate the Re for Oregon to be 0.92 and 0.98, respectively, compared to our estimate of 1.0. Imperial College London's Re estimates have not been updated since July 20.

CDC compiles hospital forecasts from numerous modelers. Compared to CDC's August 12 compilation (featuring model point estimates for August 11 and September 7), our scenario that assumed transmission continues as-is appears broadly consistent with the majority of these forecasts (Figure 4). This scenario most closely resembles the forecasts from Karlen Working Group and University of California, Los Angeles.

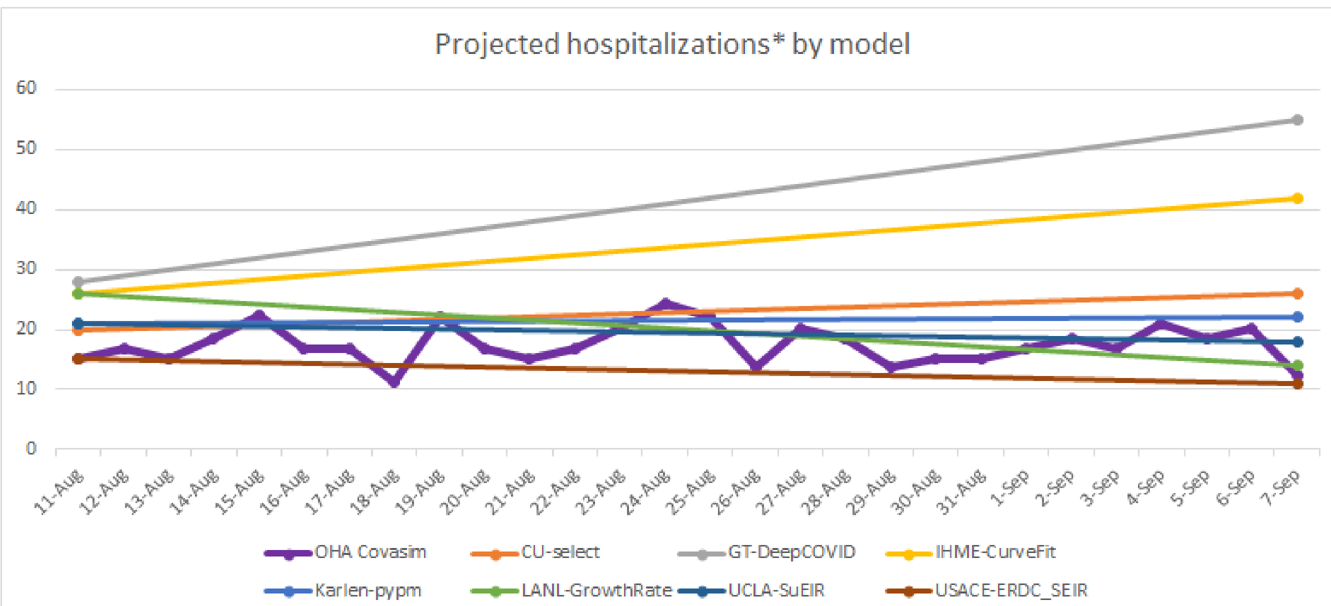


**Figure 4:** Projected daily new hospitalizations in Oregon through September 7 for the current report's scenario that assumed estimated transmission "continues as-is" (OHA Covasim) and other models included in CDC's hospital forecast compilation[4], as of August 12. *Note: OHA forecast is for severe cases, of which approximately 6% are non-hospitalized deaths.

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[3] These websites mentioned in this section were accessed on 8/18/2020.
[4] The Johns Hopkins model was not included because recent projections were at a much higher level than observed data.

## APPENDICES

### Appendix 1: Detailed transmission model methods

We applied Covasim version 1.4.7, an individual-based (i.e., "agent-based") COVID transmission model with parameters informed by the literature; the full source code is available on GitHub. The methods and assumptions for Covasim are described in detail here.

The model was calibrated by modifying the assumptions to best fit data from Opera on confirmed positive COVID-19 diagnoses, number of tests completed, and severe cases (hospitalizations and deaths) for Oregon.

Our model assumed random network connections, zero noise, and used default parameters from Covasim version 1.4.7, except for the following changes:

1) Population age distribution was based on American Community Survey 2018 single-year estimates for Oregon. We used a simulation population size of 420,000 with Covasim's population rescaling functionality enabled.
2) The COVID-19 virus had a pre-intervention Beta value[5] of 0.021, instead of 0.016 (based on observed severe cases before interventions took effect).[6]
3) We adjusted Covasim's age-specific severe outcome probability parameters among all infections to be consistent with CDC's suggested parameter values for pandemic planning scenarios (CDC Planning Scenarios as of May 20, 2020). Specifically, we used the CDC parameter values for age-specific hospitalization probabilities among symptomatic infections and adjusted them based on Covasim's age-specific symptomatic probability parameters. After applying Oregon's age distribution and time-varying age-specific susceptibility ratios (see point #4), our model estimates overall proportions of infections that become severe as 2.8% prior to May, and 2.0% for May-onward. These proportions are lower than in previous reports due to updated susceptibility ratios (see point #5).
4) We adjusted Covasim's age-specific probability of death parameters based on local ratios of deaths to severe cases by age.
5) Parameter assumptions were modified to vary susceptibility by age and time, such that the age distribution of severe cases in the model follows that of severe cases in Oregon over two time periods: February-April and May-July. The susceptibility odds ratios used in these respective time periods were: [2.84, 3.40] for age 0-9, [0.66, 1.19] for age 10-19, [1.17, 1.03] for age 20-29, [0.46, 0.52] for age 30-39, [0.50, 0.43] for age 40-49, [0.86, 0.66] for age 50-59, [0.77, 0.40] for age 60-69, [0.87, 0.54] for age 70-79, and [1.12, 0.88] for age 80 and higher. These ratios may partially correspond to biological susceptibility by age but are also a reflection of social behavior and testing activity. The

[5] Whenever a susceptible individual comes into contact with an infectious individual on a given day, transmission of the virus occurs according to probability Beta ($\beta$).
[6] With an average of 20 contacts per individual per day and a mean duration of infectiousness of 8 days, this per-day probability roughly translates to a basic reproduction number (R0) of 3.

populations of both diagnosed and severe cases have become younger over time in Oregon, implying a lower overall severe case risk among infections and thus more total infections per severe case in recent months.

6) To assess our parameter assumptions, we compared our model estimates of cumulative infections with what we might expect from a local seroprevalence study. That study (MMWR article) reported a crude seroprevalence of 1.0% (95% confidence interval: 0.2% – 1.8%) among a sample of people in Oregon interacting with the medical system between May 11 and June 15, 2020. Given the seroprevalence in that study varied by age and the sample was older than the general Oregon population, we calculated an age-adjusted seroprevalence for comparison and found it to be slightly lower (0.6%), but within the confidence bounds of the crude estimate. In the current report, the model estimated 39,100 cumulative infections on May 31. This would translate to a seroprevalence of 39,100 / 4.2million = 0.9%, which is similar to the seroprevalence estimate from the MMWR article.
7) We determined transmission levels through mid-July based on severe case incidence and adjusted the assumptions about testing practices to reflect the observed test positivity rates. Specifically, the relative probability of symptomatic individuals being tested was adjusted to match actual diagnoses counts given our inputted number of tests, with changes in relative odds occurring on April 23, May 20, June 20, and July 31.

It is not possible to calibrate the model with a single importation event near the first diagnosis (February 21, 2020), which was a community acquired infection. To match observed epidemic trends, we started the model with 90 infected individuals on February 15, 2020.

## Appendix 2: Limitations

- The results in this report will be updated as more data become available, the science to inform the model assumptions expands, and modeling methods continue to be refined. The report uses the best available local data as of August 17, 2020; however, the local epidemiologic data on COVID-19 cases may lag in ways we did not account for. Data improvement efforts are ongoing.
- Our parameter assumption for the proportions of all infections (diagnosed or not) that become severe cases was based on CDC's hospitalization-among-symptomatic estimates and Covasim default symptomatic-among-infection estimates, then adjusted to observed local severe cases by age. However, there is considerable variability in this estimate in the literature. Underestimating this proportion would inflate our estimates of total number of infections (diagnosed or not), while overestimating would deflate the number.
- After the initial imported infections, the model assumes that no additional infections were imported from elsewhere over time. Any such infections would inflate local transmission levels, though any actual resulting diagnoses and severe cases in Oregon from imported infections are included in the data used for model calibration.
- For simplicity, we assumed random network connections and a combined effect of various interventions for the future scenarios (e.g., physical distancing, expanded testing and contact tracing) on overall transmission, but Covasim does have the ability to incorporate more complex network dynamics and specific intervention effects (as described here).
- We assumed that individuals who were diagnosed subsequently reduced their transmission by 80%, but this reduction may vary as social norms change.
- Our model assumed that diagnoses occur uniformly among individuals experiencing symptoms. On any given day, those with mild symptoms were assumed to be as likely to be diagnosed as those with more severe symptoms. We do not expect this to have a major effect on the model's estimate of transmission, however, because although severe cases are infectious longer, they are assumed to be less infectious over time.
- Although our model was calibrated to track actual numbers of tests and diagnoses, it assumed both occurred entirely among symptomatic individuals. It also did not explicitly account for reduced transmission from individuals who are not tested but undergo quarantine due to contact tracing efforts.
- Given the fairly low number of cases in Oregon, trends in cases and the age distribution (and therefore prognosis) are sensitive to a single outbreak or super spreader event. Such outbreaks would be expected to affect a younger population than outbreaks in nursing homes, which occurred beginning early in Oregon's epidemic (OHA Weekly COVID-19 Report).
- These models simulated the spread of COVID-19 in Oregon statewide under different scenarios. They did not take into account regional variability, nor the complex disease spread or intervention effectiveness within and between specific populations over time, such as for communities of color, workers in certain occupations, or people in

congregate settings. However, the demographics of cases diagnosed over time in Oregon have been changing, as documented in OHA’s weekly COVID-19 report.

- Our model now counts COVID-19 deaths who were never hospitalized (primarily residents of congregate settings such as long-term care facilities) as severe cases. However, available data do not allow us to account for cases who reach severe medical status but recover without hospitalization.

Finally, significant unknowns remain, including information about public adherence to guidance (e.g., physical distancing, face coverings, hygiene, isolation, quarantine), the disease dynamics, and treatment. As CDC stated (CDC Planning Scenarios) “new data on COVID-19 are available daily; information about its biological and epidemiological characteristics remain limited, and uncertainty remains around nearly all parameter values.”