COVID-19 transmission across Washington State

Washington State Department of Health
June 16, 2021

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Publication Number 820-114

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SitRep 35: COVID-19 transmission across Washington State

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Results as of June 15, 2021.

We are publishing situation reports on a biweekly schedule on Wednesdays to better accommodate news cycles. If, on an off week, we identify a time-sensitive feature in the data, we will produce an updated report that week to ensure that changes in the situation are reported quickly.

The current Situation Report is based on complete data through June 3. The most recent 10 days are considered incomplete as it takes several days for the Washington State Department of Health to receive 90% of reported cases, hospitalizations and deaths. We continue to work on decreasing these time frames. Note that both statewide and county-specific trends since June 3 may have changed. To assess changes, you can review the case, hospital admission, and death trends including incomplete data on the Epidemiology Curves tab of the WADoH COVID-19 data dashboard. Incomplete data will continue to populate in the coming days, so flattening or decreasing trends may or may not persist. Increasing trends in the incomplete data, though, will likely only grow.

For a comprehensive and up-to-date picture of what's happening around the state, see the WA State COVID-19 Risk Assessment and WADoH COVID-19 data dashboards.

Summary of current situation

Overview: Current model results based on data through June 3 indicate that COVID-19 transmission is flat in Washington state with R-effective close to 1 as of May 28. The declines in prevalence that were evident through mid-May have flattened from late May to early June.

Cases: Case counts show signs of decline statewide and in many counties, though the declines have recently flattened. Case rates are declining or flat at low levels in all age groups.

Hospital admissions: Hospital admission rates show recent signs of declining in all age groups except among ages 80+, where admissions are flattening after previous increases. Hospital occupancy has recently begun to decline.

Vaccination: The proportion of the population with vaccine-derived immunity is over twice that with natural immunity statewide, indicating the important role of vaccination in reducing transmission. However, vaccination shows recent signs of slowing, with an average of ~30,677 doses administered per day as of June 14. Nearly 75% of the 65+ population has been fully vaccinated, but 20% of the 65+ population has not yet initiated vaccination, and about 53% of the overall population remains susceptible.

Variants: More transmissible variants that potentially pose an increased risk of severe illness continue to spread across the state. Projections based on data through May 25 indicate that although the fraction of cases attributable to B.1.1.7/alpha (~40%) show signs of declining, and P.1/gamma (~20%) growth may be flattening, the B.1.617.2/delta variant shows rapid growth, and may currently account for around 20% of cases.

Public health message: Current trends are moving in the right direction, and continued vaccination and maintenance of non-pharmaceutical interventions (masking, avoiding indoor gatherings) among the unvaccinated are necessary to minimize the potential for outbreaks and disease increases.

Statewide estimates of the effective reproductive number

Using data from the [Washington Disease Reporting System](#) (WDRS) through June 3, we are reporting the reproductive number (R_e) as of May 28. The green line and green-shaded region shows estimates of total R_e which includes contributions from behavior, variants, and population immunity, either from prior infection or due to vaccination. On May 28, $R_e$was likely between 0.74 and 1.32, with a best estimate of 1.03. Vaccination has been effective in reducing transmission, as the R_e unadjusted for population immunity is well above one. However, the current estimate of total R_e remains very close to one. To reduce levels of cases and hospitalizations, total R_e needs to maintain a value substantially below 1 for a sustained period of time through a combination of vaccination and population behavior (maintaining masking and distancing until fully protected via vaccination).

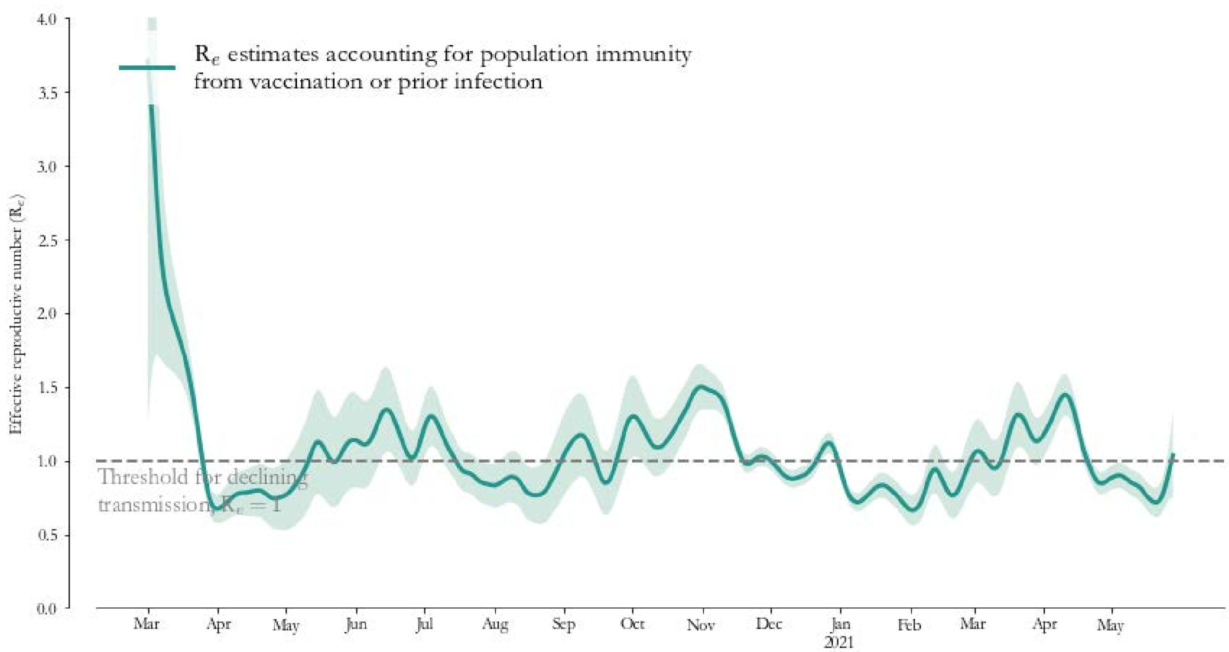


***Figure 1**: R_e estimates for Washington state. The green line and green-shaded region depict the "total" R_e, which accounts for behavior, variants, and population immunity.*

Model-based statewide prevalence

On June 3, overall prevalence (the percentage of Washington state residents with active COVID-19 infection) in Washington state was likely between 0.14% and 0.29%, with a best estimate of 0.21% (Figure 2). The decline in prevalence flattened in late May, after the steady decline that began in mid-April.

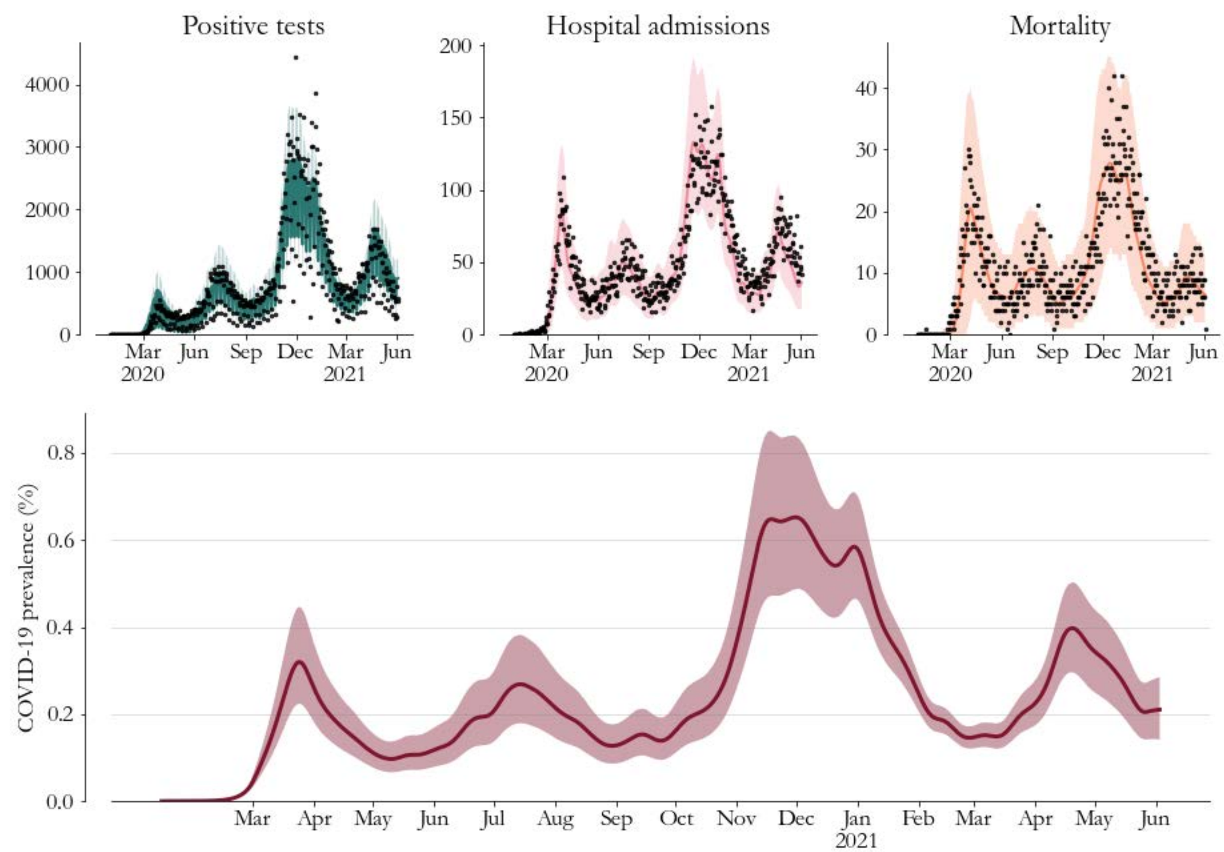


***Figure 2**: Model-based prevalence estimates (bottom, 95% CI shaded) and model fit to cases (top left), hospitalizations (top middle) and deaths (top right) for Washington state. Prevalence is the percentage of Washington state residents with active COVID-19 infection.*

Model-based statewide immunity

On June 3, we estimate that overall population immunity to SARS-CoV-2 in Washington state was between 45.7% and 48.3% with a best estimate of 47.0% (Figure 3). Immunity derived from vaccination was around 33.3% (95% uncertainty interval: 32.4% to 34.3%), and immunity derived from prior infection was around 13.6% (95% uncertainty interval: 11.4% to 15.8%). Currently, the percent of the population with vaccine-derived immunity is over double that with naturally-derived immunity. That said, the increase in vaccine-derived immunity that began in February began to flatten in early May.

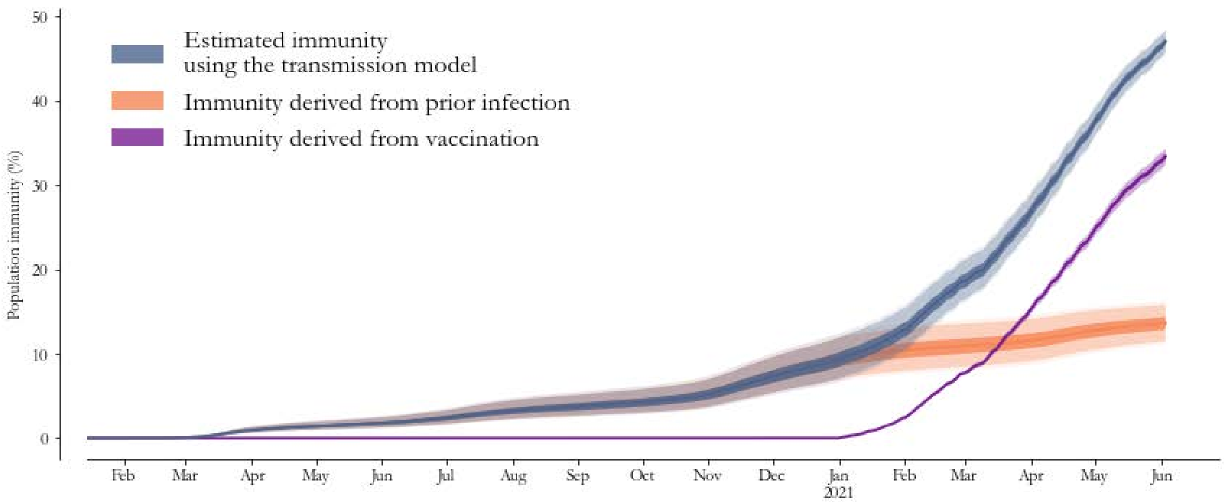


Figure 3*: Model-based estimates of population-level immunity to SARS-CoV-2 infection as of June 3. Overall population immunity is indicated in the blue line and shaded area. The percent of the population deriving immunity from vaccination at least 14 days prior is shown in purple, and the percent deriving immunity from prior infection, is shown in orange. Note that these estimates assume that either prior infection or vaccination give individuals long-term immunity against all SARS-CoV-2 variants, so waning of immunity after infection is not accounted for.*

Trends in cases, hospital admissions, and deaths

Case counts have continued to decline since late April, with signs of slight flattening recently. The seven-day rolling average case count declined from a peak of 2931 on January 8 to 741 cases per day as of February 15, remained at that level for a month, increased to 1506 cases per day as of April 23, and has since declined to 558 as of June 3.

Hospital admissions have continued to decline since late April, though a slight flattening in the decline is evident in early June. The seven-day rolling average of hospital admissions declined from a peak of 116 on January 6 to 31 as of March 6, flattened near that level until late March, increased to a peak of 82 as of April 27, and has since declined to 47 as of June 3.

Deaths have remained fairly flat, with some variability, since late March, but there may be a slightly increasing trend as of early May. The seven-day rolling average of deaths declined from a peak of 32 on January 10 to 5 as of March 23. Since then it has varied between 5 and 10 deaths per day and is currently at 9 as of May 24 (note that there is an earlier cut-off date for deaths because of the additional time it takes for deaths to be verified and entered in the state vital records database).

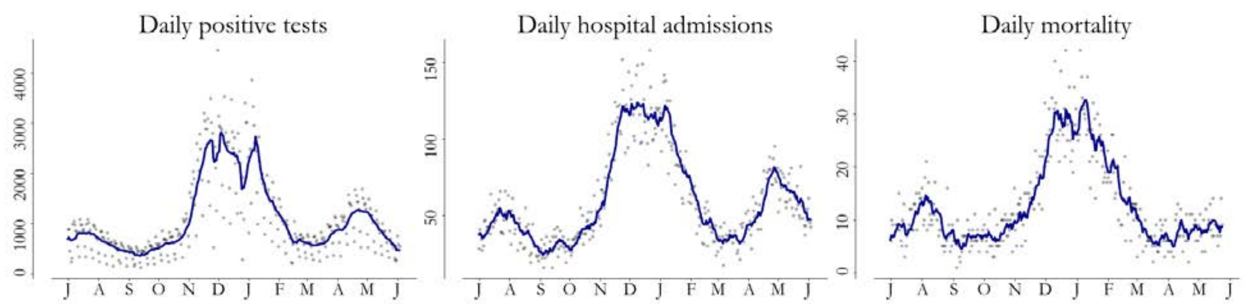


***Figure 4**: Seven-day rolling case counts (left panel), hospital admissions (middle panel) and deaths (right panel) for Washington from July 2020 through June 3 (cases and hospitalizations) and May 24 (deaths) 2021. Because of how confirmed deaths are being reported, we are using an earlier cutoff for data on daily mortality.*

County-level trends

Case rates: Across Washington state as of June 3:

- 1 county had no new cases over the prior two weeks (Garfield).
- 15 counties had 14-day rates of new cases between 100 and 200 per 100,000 people.
- 3 counties (Grays Harbor, Wahkiakum, Lincoln) had rates above 200 per 100,000. Rates in Lincoln county are particularly high currently at 624 per 100,000 people.

Case counts: County-level case counts show trends towards flattening or declining in most counties as of June 3:

- All of the five largest counties (Clark, King, Pierce, Snohomish, Spokane) had declining case counts, but Clark, King, Pierce, and Snohomish show recent flattening in these declines.
- Among middle-sized counties, case counts are flat in Benton, Franklin, Grant, and Yakima counties, and are declining in Cowlitz, Kitsap, Thurston, and Whatcom counties.
- Among small counties, case counts have decreased in Grays Harbor and flattened in Lewis, following increases in those counties in May. All other small counties still have fewer than 10 counts per day, but increases are evident in Douglas, Lincoln, and Wahkiakum counties and in the incomplete data for Clallam and Jefferson counties.

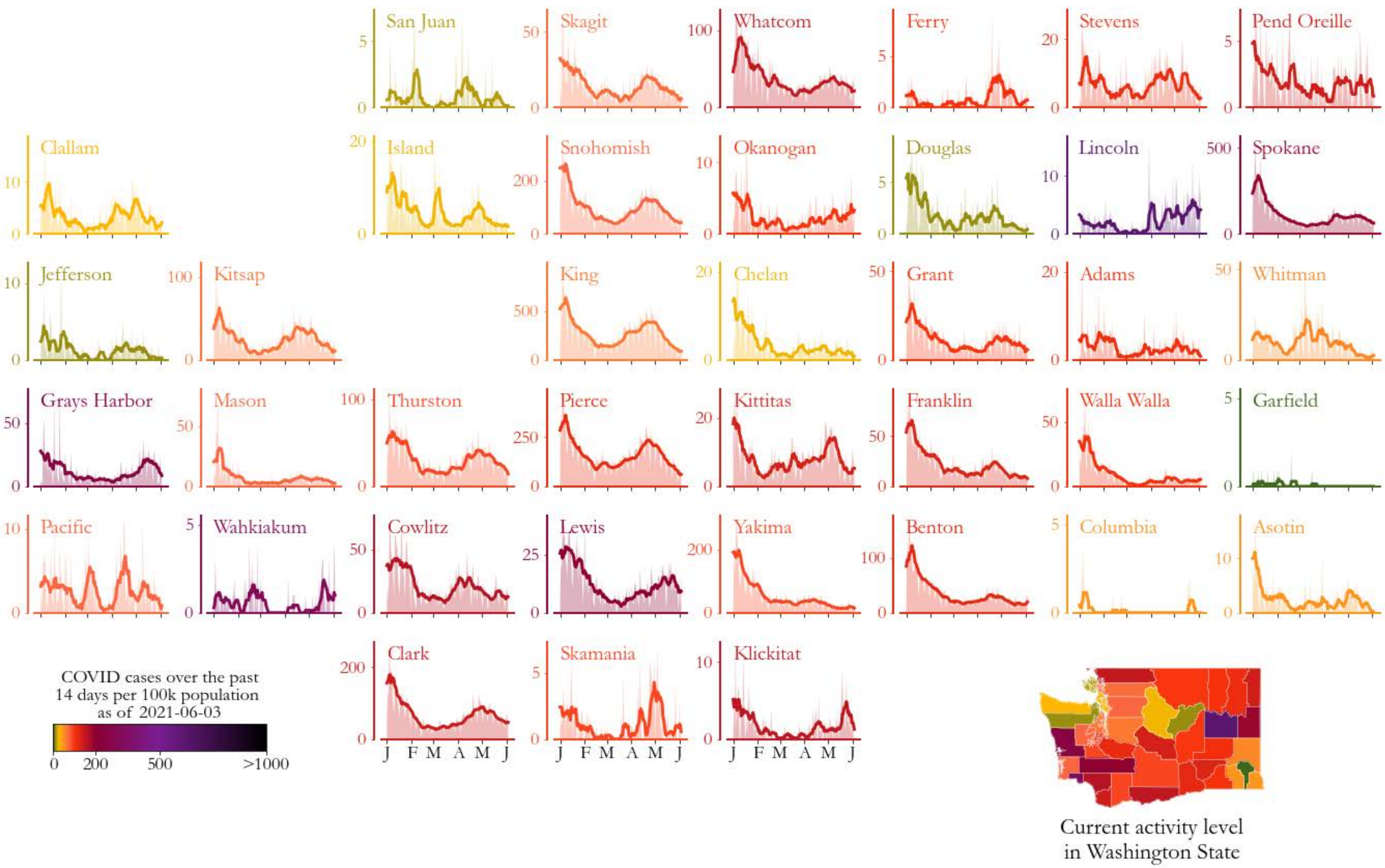


Figure 5*: Daily COVID-19 positives (shaded areas) and 7-day moving averages (curves) arranged geographically and colored by COVID-19 activity level (total cases from May 21 to June 3 per 100,000 people). Case trends across counties highlight geographic correlations and help us better understand region-level estimates of the transmission rate (see Figure 1).*

Trends in case rates by age group

Across Washington state, 14-day case rates (cases per 14-day period per 100,000 people) increased in most age groups through late-April or early May, and then began to decline (Figure 6). As of June 3, case rates are declining in all age groups except among ages 70 and over, where they have been fairly flat since March. In ages 20-69, declines in rates almost approach the low levels last seen in March.

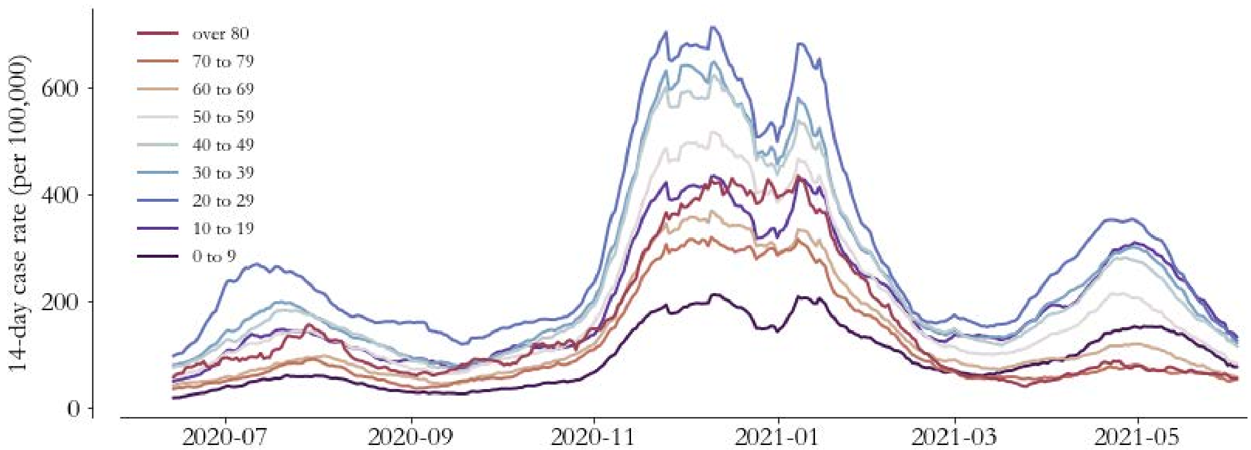


Figure 6. *14-day case rates by 10-year age group across Washington state, as of June 3, 2021.*

The top panel of Figure 7 indicates that a smaller proportion of adults aged 60 and older have tested positive since mid-February in comparison to the proportion of the population belonging to this age group. Until mid-May, the 20-29 year old age group accounted for a disproportionately large fraction of cases in comparison to the population fraction for this age group, but as of early June, the fraction of cases in this age group has become closer to their proportion of the population. The bottom panel shows that overall testing by age has remained fairly proportional to the population age distribution.

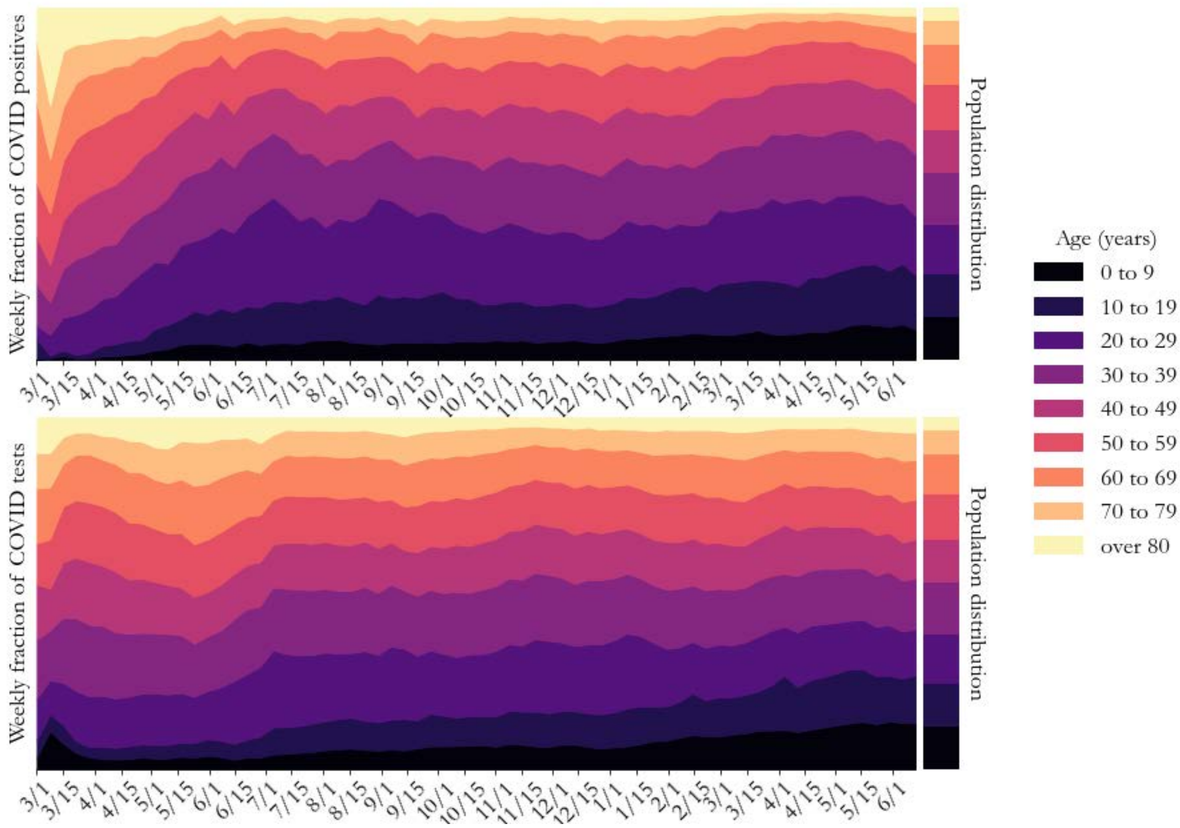


Figure 7. *The top panel of this graph shows the weekly age distribution of COVID-19 cases and the bottom panel shows the weekly age distribution of COVID-19 tests. The colors represent 10-year age groups. Early in the pandemic, populations over age 60 represented a greater fraction of total COVID-19 cases relative to their fraction of the population as a whole. Over time, the age distribution of cases has shifted towards younger individuals (shown in darker colors). In comparison, the bottom panel indicates that this trend is generally not present in the distribution of tests, which indicates that the age-distribution of the underlying infected population is changing over time.*

Trends in hospital admission rates by age group

Hospital admission rates (first hospital admissions per 14-day period per 100,000 population) across Washington state began increasing across all age groups in mid-March. These increases flattened earlier among ages 80+, in early April, but persisted in other age groups until early May. As of June 3, declines are evident in all age groups spanning ages 20 to 79 and admission rates have flattened after the earlier increases in the 80 and over age group (Figure 8).

The hospital admission data shown here are from WDRS and incorporate information from both case investigation/contact tracing, as well as syndromic surveillance, and represent the most reliable source of data on first hospital admissions for COVID-19, although data are less timely than the WA Health system. More current data (not shown) from the WA Health system, which rely on daily reports by hospital facilities around the state, also suggest declines in total hospital admission rates (rates of first admission and readmissions) in ages 20-59 as of mid June, with flattening after increases in rates in ages 60 and over.

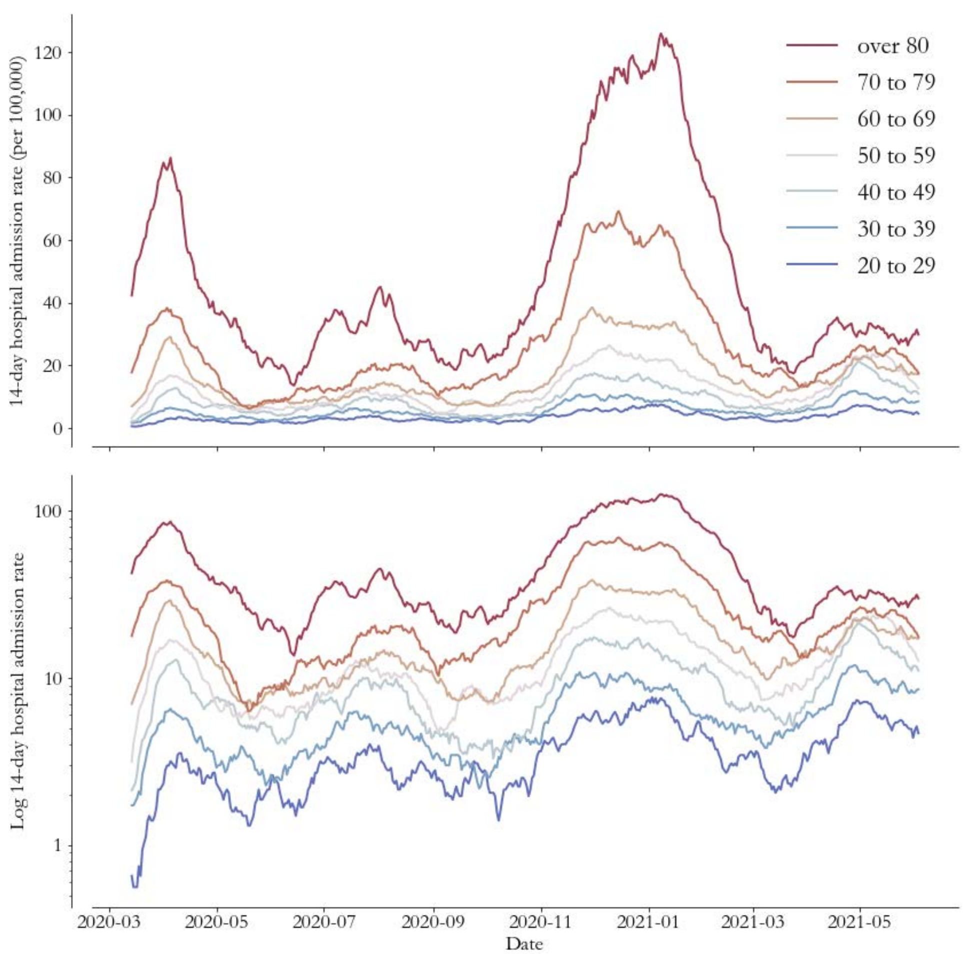
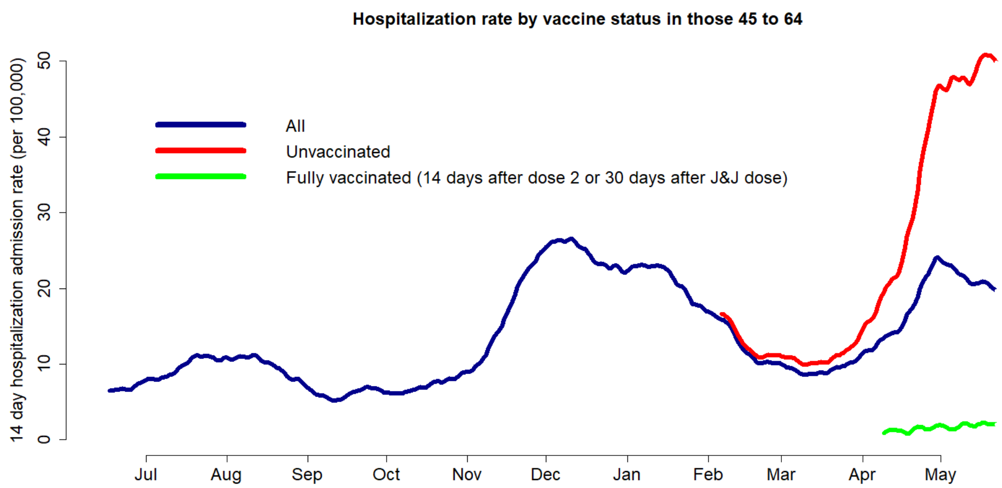


Figure 8. *Statewide 14-day hospital admission rate per 100,000 population by 10-year age group as of June 3. The top panel shows the rates on a standard numeric scale, and the bottom panel shows the rates on a log scale to be able to better compare the rate of decline between age groups that have large differences in rates.*

In order to assess the impact of vaccination on COVID-19 hospital admission rates among adults aged 45 and over, we compared two-week rates of first-time hospital admission between unvaccinated and fully-vaccinated adults in two age groups, ages 45-64 and 65+ (Figure 9). For the two week period ending on May 22, the 14-day hospital admission rate in unvaccinated individuals aged 45-64 is about 21 times higher than rates in those in this age group who are fully protected by vaccination (i.e. those who are 14 days after 2nd dose of Pfizer or Moderna vaccines, or 30 days after a Johnson & Johnson dose). The hospital admission rate in unvaccinated individuals 65 and older is approximately 15 times that in fully protected individuals in this age group. Among ages 45-64 a divergence in hospitalization trends between the overall population and the unvaccinated population is evident. The increase in hospital admission rates in the unvaccinated continued into early June, while hospital admissions overall in this age group have been declining. In the 65+ age group, hospital admission rates have flattened in the overall population, and appear to be flattening at high levels in the unvaccinated population in this age group.



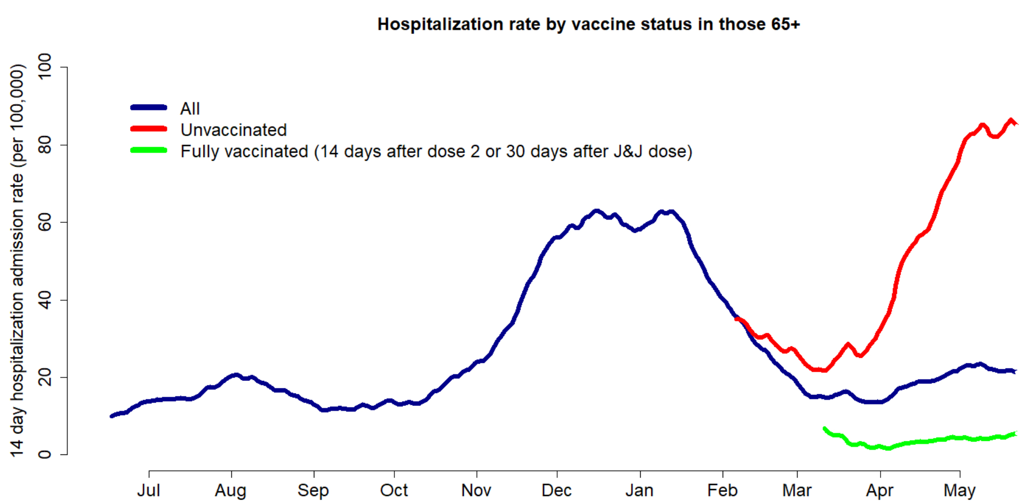


Figure 9. *Comparison of 14-day hospital admission rates between unvaccinated and fully-vaccinated adults age 45-64 (top panel) and 65 and older (bottom panel). Colors represent vaccination status, red = unvaccinated, green = those who are fully protected (14 days after 2nd dose or 30 days after J&J dose), dark blue = overall admission rate in this age group. Vaccination status of individuals hospitalized for*

COVID-19 is determined by linking case data reported to WDRS with vaccination data reporting the Washington State Information Immunization System. Estimates are adjusted for vaccinations that get reported directly to CDC, missed linkages and population growth.

Hospital occupancy

Across the state, the number of hospital beds occupied by confirmed or suspected COVID-19 patients increased until early May, flattened through mid-May, and is declining as of June 12 (Figure 10). Similarly, ICU beds occupied by confirmed or suspected COVID-19 patients increased through early May, but have since remained fairly flat through the end of May, and have since declined sharply in early June.

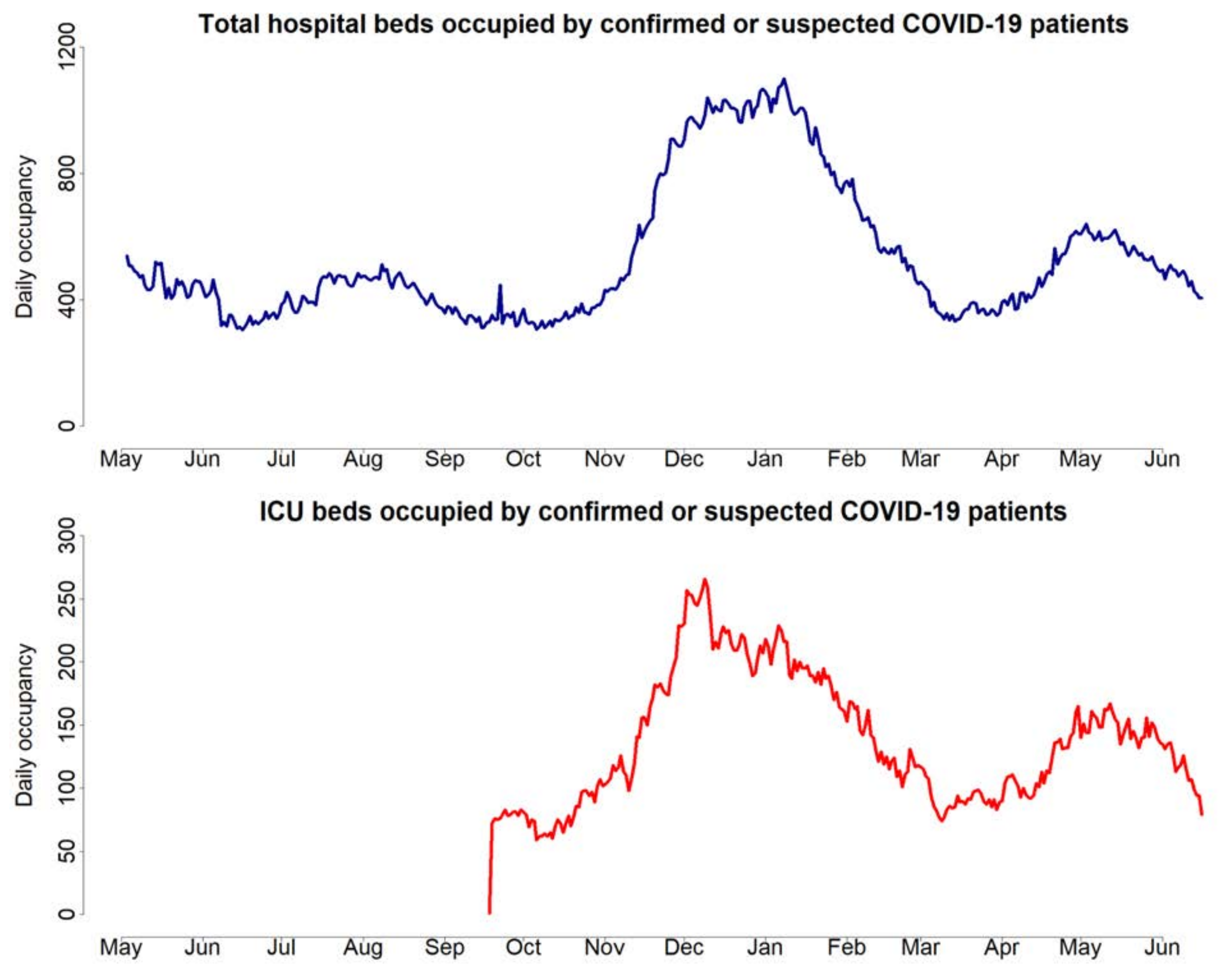


Figure 10. *Total hospital beds and ICU beds occupied by confirmed or suspected COVID-19 patients reported through the WA Health system. Data collection for ICU beds occupied by COVID-19 patients started September 17. Hospital occupancy data has minimal reporting lag, and is shown here using data up to June 12. Both confirmed and suspected cases are included, rather than just confirmed cases, since this best reflects total resources being used. Note that bed occupancy would continue to increase for a period of time even if admissions plateau since patients being treated for COVID-19 generally stay in the hospital for several days.*

Fraction of cases attributable to variants of concern

Using genetic sequence data from DOH as well as collaborating institutions on the GISAID platform, we have estimated the fraction of cases in WA that are attributable to SARS-CoV-2 variants of concern and variants of interest. Extrapolating from data available through May 25, and using a multinomial generalized additive model, we estimate that as of June 15, around 40% of cases are attributable to B.1.1.7/alpha, and about 20% are due to P.1/gamma, and about 20% are due to B.1.617.2/delta (Figure 11). Cases attributable to B.1.1.7/alpha are declining and P.1/gamma growth is flattening based on data through May 25, while B.1.617.2/delta is currently the fastest growing variant statewide. More recent DOH data from early June suggests that there may be a resurgent increase in P.1. There is considerable uncertainty in these projected estimates due to the use of a method that only approximates a representative sample, as well as the uncertainty inherent in making projections based on relatively small samples. However, the large projected growth in the B.1.617.2/delta variant is consistent with the very rapid growth pattern observed in the UK. Despite uncertainty in these estimates, they provide an informative picture of the evolution of SARS-CoV-2 variant strains in Washington state. A full report of whole genome sequencing of SARS-CoV-2 lineages circulating in Washington state is produced weekly by DOH.

Figure 11. *Estimated fraction of cases attributable to variants of concern in Washington State. Data used in this analysis exclude sequences obtained by targeting B.1.1.7/alpha. This figure shows a seven-day running average through May 25 and then a multinomial growth model nowcast through June 15. For the figure, variants of interest B.1.427 and B.1.429/epsilon have been combined as they are closely related. To assist with public discussions of variants, WHO proposed using labels consisting of the Greek alphabet, i.e. alpha, beta, gamma, as a practical way to discuss variants by non-scientific audiences.*

Implications for public health practice

Across Washington state, SARS-CoV-2 transmission has remained fairly flat since late April, following declines in early April. Total R_e has remained close to one for several weeks, despite increasing population immunity. Statewide, prevalence declined from mid-April through late May, and has flattened in early June at levels similar to those observed during the summer surge of 2020. Case counts are declining statewide with some recent flattening in those declines, and most counties are also experiencing flattening or declining trends in case counts. Similarly, case rates are flattening or declining across age groups, as are hospital admission rates. Overall hospital admissions have declined sharply since late April in most adults, except for those 80 and above. Increases in hospital occupancy have also declined as of late May. So far, there has not been a major increase in mortality associated with the most recent fourth wave of cases. However, because deaths lag case and hospital data by several weeks and data on deaths require longer time to report with completed cause of death, it is possible that we will see some increases in deaths in the near future despite declining hospitalizations. In combination, these data suggest that trends in the state are improving, but that continued vaccination and maintenance of NPIs among the unvaccinated are necessary to minimize the potential for outbreaks and disease increases.

Vaccination rates across Washington state have fallen from a high of nearly 70,000 doses/day in late April, to around 30,000 doses/day in early June, reflecting a decline in demand. The proportion of the population protected by vaccine-derived immunity is now over double the proportion protected by immunity from prior infection, showing the important role of vaccination in recent improving case and hospitalization trends. The burden of SARS-CoV-2 in Washington State is currently being experienced primarily in unvaccinated individuals. Our analysis of hospital admission rates by vaccination status indicates that as of June 7, hospital admission rates among the unvaccinated population 45-64 are 21 times as high as those in the fully vaccinated population in this age group, and in the 65+ population, hospital admission rates are 15 times as high in unvaccinated persons than in vaccinated persons. These data highlight the very strong protection against severe disease afforded by vaccination. They provide evidence of the need for greater vaccine coverage across the state population, where about 48% of all people are currently fully vaccinated as of June 14 (56% of the population 12+, and 58% of the population 16+). After accounting for the additional time after vaccination to achieve full immunity, we estimate that currently 53% of the population remain susceptible.

Variants of Concern (VOC) continue to spread across Washington state, and currently, the B.1.1.7/alpha, P.1/gamma, and B.1.617.2/delta VOC comprise the greatest proportion of circulating variants in the state. For the first time, the B.1.1.7/alpha variant is showing signs of decline due to competition from the B.1.617.2/delta variant. The B.1.1.7/alpha variant is more transmissible and is linked to more severe disease, but currently available vaccines are protective against it. The P.1 (gamma) variant is also more transmissible, and may cause more severe disease, but currently available vaccines are less protective against it. The B.1.617.2/delta variant is more transmissible than B.1.17/alpha. The observed 15-20% reductions in vaccine effectiveness against B.1.617.2/delta in the UK is primarily based on populations with a single-dose of Astra-Zeneca viral vector vaccine. There is currently insufficient evidence to assess whether there is reduction in effectiveness of 2-dose mRNA (Pfizer or Moderna) vaccines, which are most common in Washington state, against the B.1.617.2 (delta) variant.

Current declining disease trends are promising, however, greater population vaccination coverage, as well as continued caution and use of NPI until fully protected by vaccination, remain critical in order to prevent reversal of current positive trends.

Key inputs, assumptions, and limitations of the IDM modeling approach

We use a COVID-specific transmission model fit to testing and mortality data to estimate the effective reproductive number 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 the most recent technical report on the modeling methods. The estimates this week and going forward use the updated method in that report, which results in some statistically-insignificant retrospective changes to R_e relative to our previous report.
- In this situation report, we use data provided by Washington State Department of Health through the Washington Disease Reporting System (WDRS). **We use the WDRS test, hospital admission, and death data compiled on June 13, and to hedge against delays in reporting, we analyze data as recent as June 3 across the state for cases and hospital admissions, and as recent as May 24 for deaths.** This relatively conservative hedge against lags is in response to reports of increasing test delays.
- Estimates of R_e describe average transmission rates across large regions, and **our current work does not separate case clusters associated with known super-spreading events from diffuse community transmission.**
- Results in this report come from data on testing, confirmed COVID-19 cases, and deaths (see previous WA State report for more details). Also as described previously, estimates of R_e are based on an adjusted epi curve that accounts for changing test availability, test-positivity rates, and weekend effects, but all biases may not be accounted for.
- This report describes patterns of COVID transmission across Washington state, 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.
- **Our modelling framework has been updated to take vaccination data into account.** Detailed methodological documentation is currently being prepared by the Institute for Disease Modeling. At a high level, based on observational data, our approach assumes that on average 58.0% (52% to 64% 95% CI) of those vaccinated after the first dose and an additional 24.4% after the second dose (for a total of 82.4% [95% CI: 77% to 87%) are protected from SARS-CoV-2 infection 14 days after each dose. Among vaccinated people not protected from SARS-CoV-2 infection, our modelling framework assumes roughly 20% to be protected from experiencing severe COVID-19 symptoms (i.e. hospitalization or death) while still able to transmit the virus. One critical limitation to note is the use of the same assumptions for all vaccines. Therefore, for this report, the single-shot Johnson & Johnson vaccine was considered equivalent to first-doses of the Pfizer or Moderna vaccines. This limitation is not expected to have a large influence on results since the Johnson and Johnson vaccines currently constitute a small proportion (less than 4%) of the total vaccine doses administered to-date in Washington state.

Collaboration notes

The Institute for Disease Modeling (IDM), Microsoft AI For Health, the University of Washington, and the Fred Hutchinson Cancer Research Center are working with WA DoH to provide support for regional modeling of case, testing, and mortality data across Washington State to infer effective reproduction numbers, prevalence, and incidence from data in the Washington Disease Reporting System. Modeling and analysis for the report are led by WA DoH and are based on models developed by IDM and advanced by Microsoft to better represent the state. The WA DoH wishes to thank IDM for their support in model development and implementation for this report, in particular, Dr. Niket Thakkar, PhD, of IDM, who developed and shared software and programming scripts and provided technical and scientific advice to

the WA DoH. This collaboration has evolved alongside the science, data systems, and analysis behind the models, and it reflects the ongoing commitment of all parties involved to improve our understanding of COVID-19 transmission and to support WA DoH in its public health mission. This collaboration and its outputs will continue to evolve as scientific frontiers and policy needs change over time.

These reports were previously published on the IDM InfoHub. Going forward, as of December, 9, 2020, new reports will be published on the DOH website. IDM will continue to provide technical assistance for the reports, as part of this collaboration.