COVID-19 transmission across Washington State

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SitRep 36: COVID-19 transmission across Washington State

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Results as of June 29, 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 17. 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 17 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 17 indicate that COVID-19 transmission in Washington state has been declining slightly, with R-effective close to 1 as of June 11. R-effective has remained below one since early May. Prevalence of COVID-19 has continued to decline since late April.

Cases: Case counts show continued signs of decline statewide and in many counties, though the statewide rate of decline has flattened as of June 17. 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. Overall COVID-related hospital occupancy declined through late June, but ICU beds occupied by confirmed or suspected COVID-19 patients recently increased.

Vaccination: The proportion of the population with vaccine-derived immunity is nearly three times 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 ~18,467 doses administered per day as of June 26. Just over 75% of the 65+ population has been fully vaccinated, but 19% of the 65+ population has not yet initiated vaccination. As of June 17, about 50% 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 June 3 indicate that although the fraction of cases attributable to B.1.1.7/alpha (~24%) show signs of declining, and P.1/gamma (~30%) growth may be flattening, the B.1.617.2/delta variant shows rapid growth, and may currently account for around 33% of cases.

Public health message: Current trends continue to move 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 17, we are reporting the reproductive number (R_e) as of June 11. 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 June 11, R_e was likely between 0.27 and 1.13, with a best estimate of 0.70. Vaccination has been effective in reducing transmission, as the R_e unadjusted for population immunity is well above one. Total R_e has been declining since May. However, the wide uncertainty intervals around the current estimate indicates that R_e may be closer to one than the point estimate of 0.7 suggests. 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).

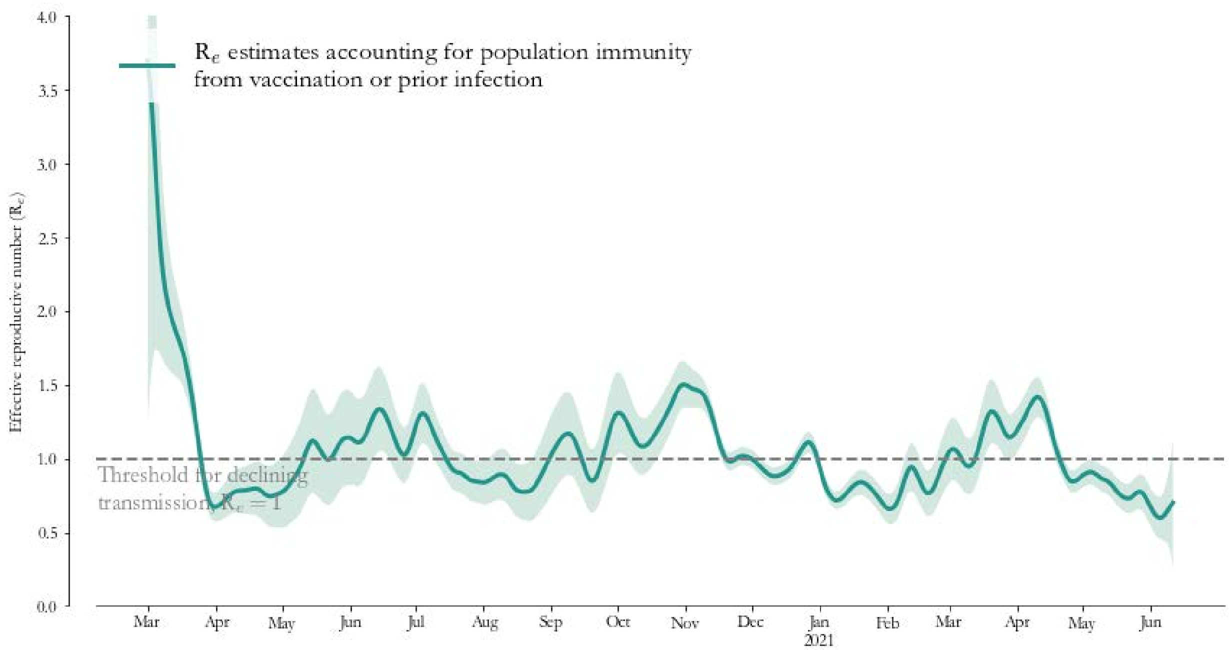


***Figure 1**: R_e estimates for Washington state. The green line and green-shaded region depict the "total" R_e, which accounts for behavior, variants, and population immunity.*

Model-based statewide prevalence

On June 17, overall prevalence (the percentage of Washington state residents with active COVID-19 infection) in Washington state was likely between 0.06% and 0.13%, with a best estimate of 0.09% (Figure 2). The decline in prevalence that began in late April has continued through mid-June, and prevalence has now dipped below the low level last observed in March.

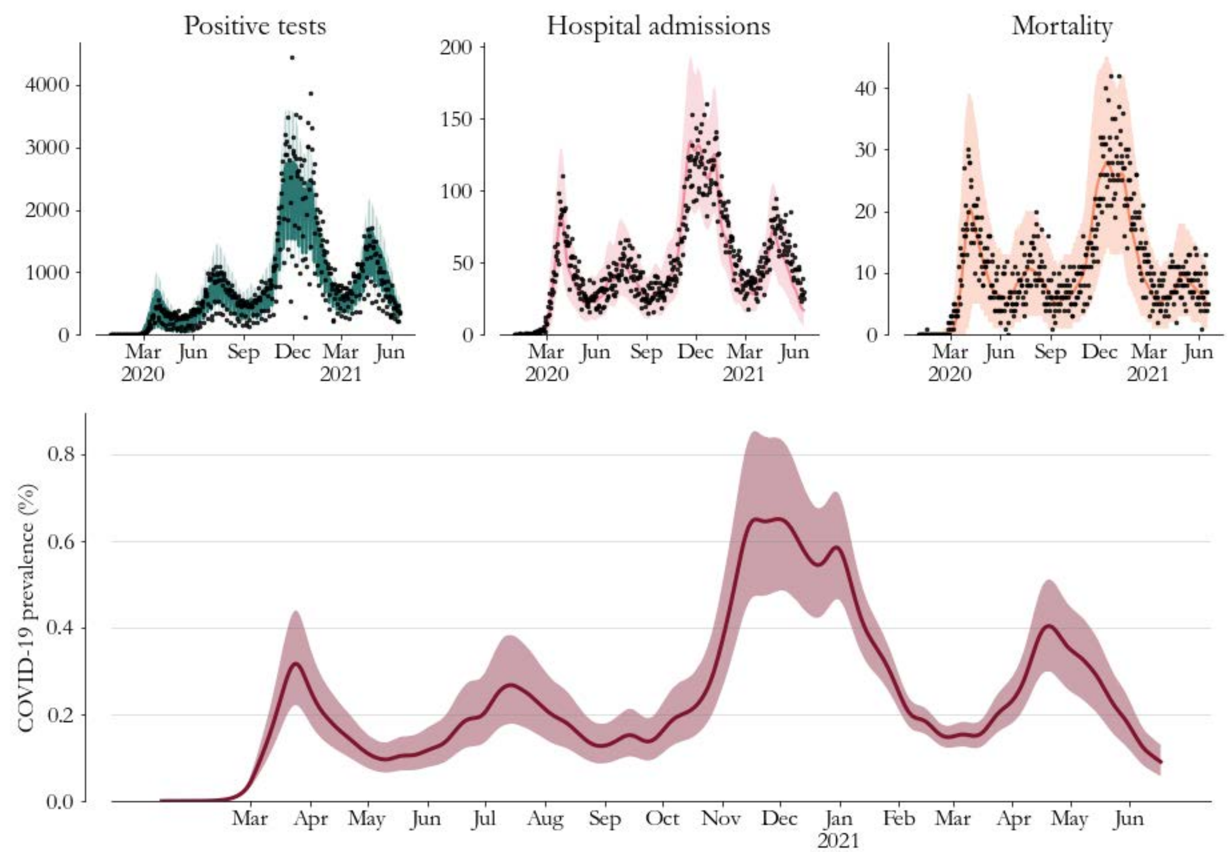


***Figure 2**: Model-based prevalence estimates (bottom, 95% CI shaded) and model fit to cases (top left), hospitalizations (top middle) and deaths (top right) for Washington state. Prevalence is the percentage of Washington state residents with active COVID-19 infection.*

Model-based statewide immunity

On June 17, we estimate that overall population immunity to SARS-CoV-2 in Washington state was between 48.2% and 50.7% with a best estimate of 49.5% (Figure 3). Immunity derived from vaccination was around 35.8% (95% uncertainty interval: 34.7% to 36.8%), and immunity derived from prior infection was around 13.7% (95% uncertainty interval: 11.6% to 15.8%). Currently, the percent of the population with vaccine-derived immunity is a little under three times that with naturally-derived immunity. That said, the increase in vaccine-derived immunity that began in February began to flatten in early May.

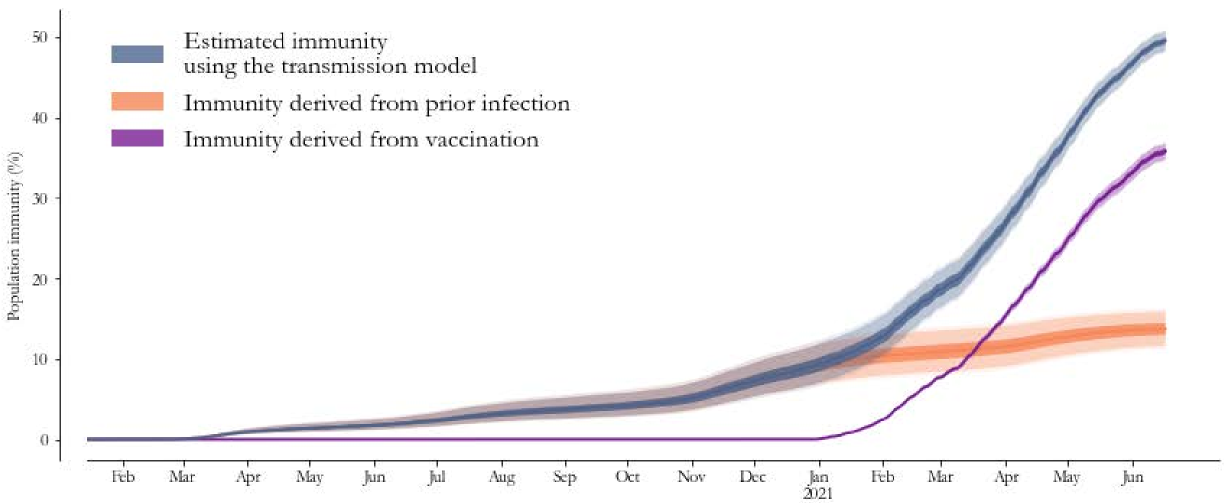


***Figure 3**: Model-based estimates of population-level immunity to SARS-CoV-2 infection as of June 17. Overall population immunity is indicated in the blue line and shaded area. The percent of the population deriving immunity from vaccination at least 14 days prior is shown in purple, and the percent 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 2932 on January 8 to 743 cases per day as of February 15, remained at that level for a month, increased to 1511 cases per day as of April 23, and has since declined to 409 as of June 17.

Hospital admissions have continued to decline since late April, though a flattening in the decline is evident in the incomplete data after June 17. The seven-day rolling average of hospital admissions declined from a peak of 117 on January 6 to 31 as of March 6, flattened near that level until late March, increased to a peak of 83 as of April 27, and has since declined to 29 as of June 17.

Deaths have remained fairly flat, with some variability, since late March, though there may be a slightly increasing trend starting in 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 6 as of June 7 (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).

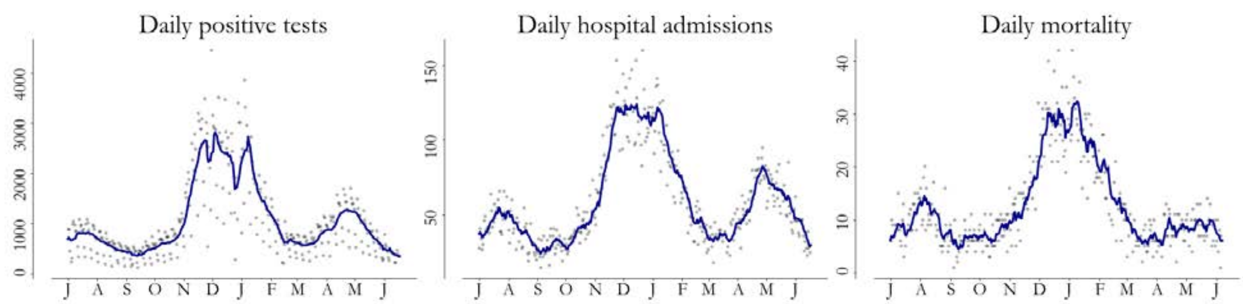


***Figure 4**: Seven-day rolling case counts (left panel), hospital admissions (middle panel) and deaths (right panel) for Washington from July 2020 through June 17 (cases and hospitalizations) and June 7 (deaths) 2021. Because of how confirmed deaths are being reported, we are using an earlier cutoff for data on daily mortality.*

County-level trends

Case rates: Across Washington state as of June 17:

- 2 counties had no new cases over the prior two weeks (Garfield, San Juan).
- 10 counties had 14-day rates of new cases between 100 and 200 per 100,000 people.
- 2 counties (Wahkiakum, Lincoln) had rates above 200 per 100,000, but rates in both counties are on the decline.

Case counts: County-level case counts show trends towards flattening or declining in most counties as of June 17:

- Among the five largest counties Clark, Pierce, and Spokane had declining case counts. King shows some flattening in the declines in case counts, and case counts in Snohomish have largely flattened after declining through early June.
- Among middle-sized counties, case counts are flat in Benton, Franklin, Kitsap, Thurston, Whatcom, and Yakima counties. Cowlitz shows recent increases. Grant and Skagit currently have fewer than 10 counts per day.
- Among small counties, Walla Walla is seeing recent gradual increases in case counts. All other small counties have fewer than 10 counts per day, but slight increases are evident in Adams county.

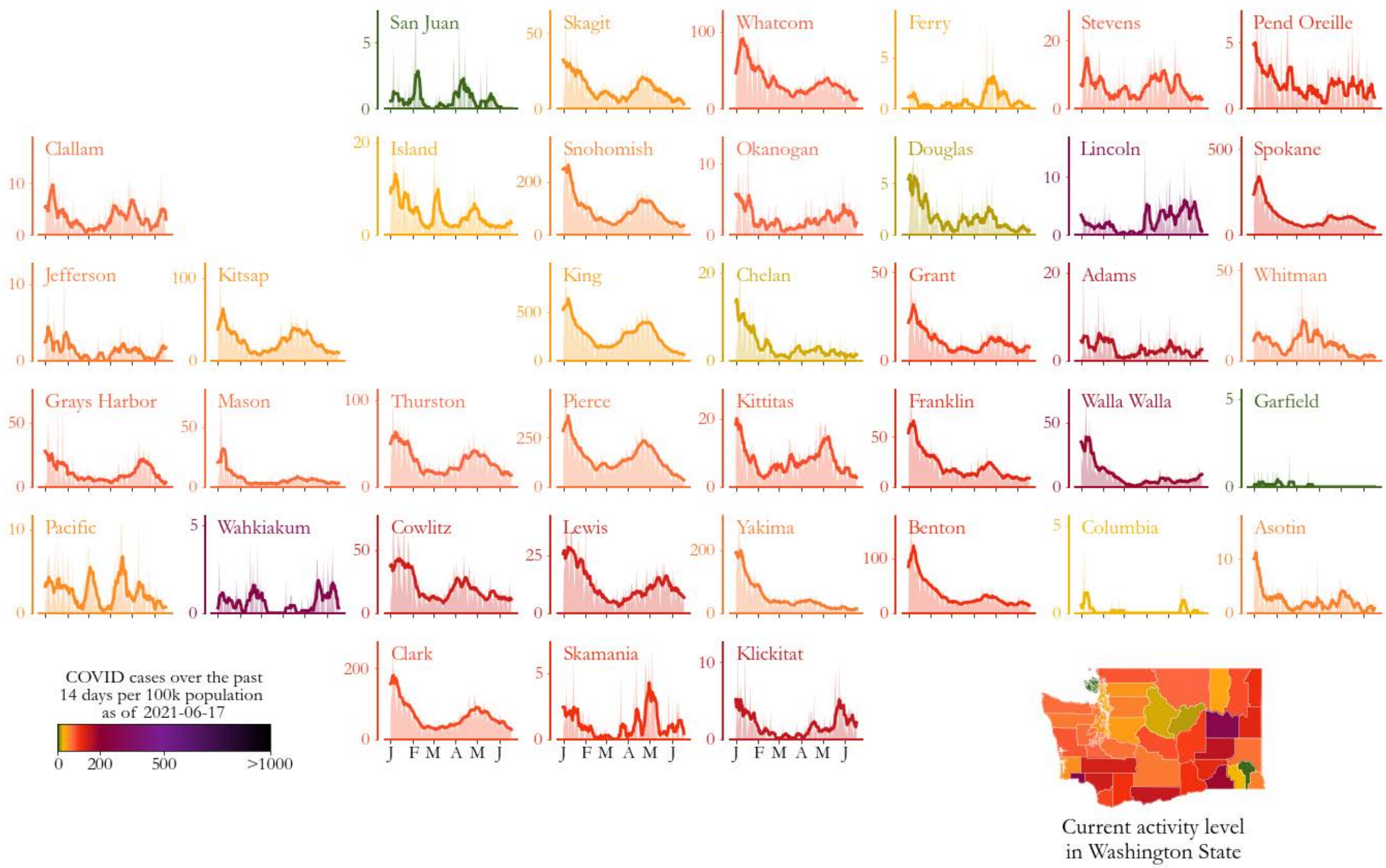


Figure 5*: Daily COVID-19 positives (shaded areas) and 7-day moving averages (curves) arranged geographically and colored by COVID-19 activity level (total cases from June 4 to June 17 per 100,000 people). Case trends across counties highlight geographic correlations and help us better understand region-level 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 17, 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, rates are at or below the low levels last seen in March.

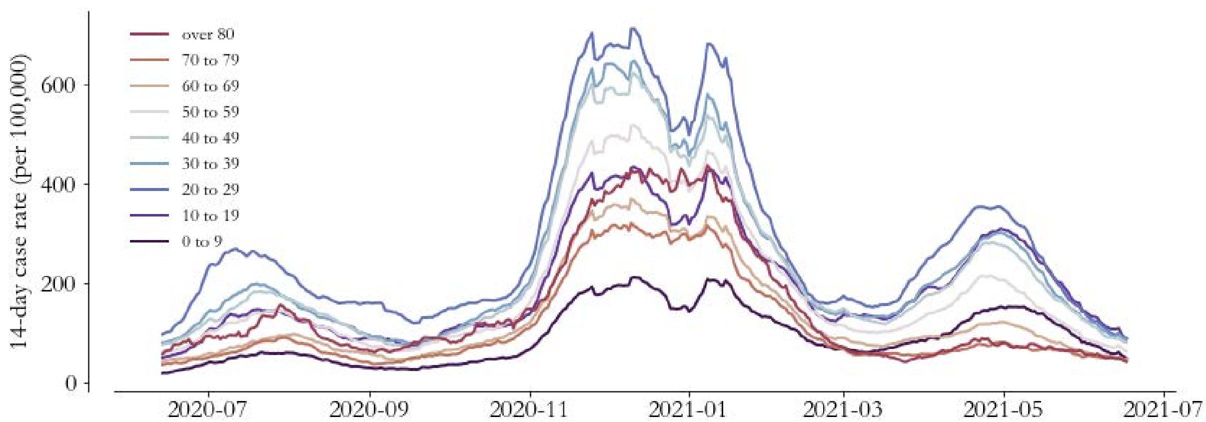


Figure 6. *14-day case rates by 10-year age group across Washington state, as of June 17, 2021.*

Proportion of cases and tests by age group

The top panel of Figure 7 indicates that a smaller proportion of adults aged 60 and older have tested positive since mid-December, with further decrease after mid-February, in comparison to the proportion of the population belonging to this age group. The 20-29 year old age group continues to account for a disproportionately large fraction of cases in comparison to the population fraction for this age group. The bottom panel shows that overall testing by age has remained fairly proportional to the population age distribution.

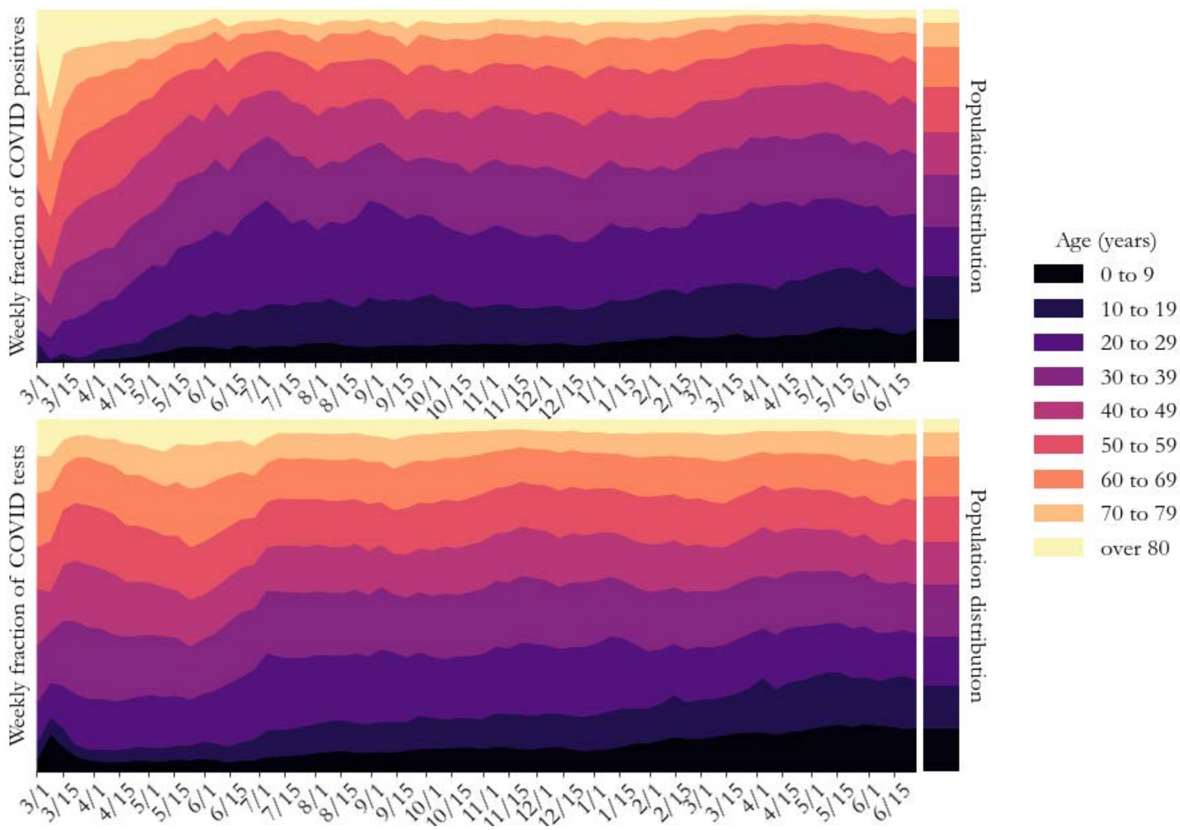


Figure 7. *The top panel of this graph shows the weekly age distribution of COVID-19 cases and the bottom panel shows the weekly age distribution of COVID-19 tests. The colors represent 10-year age groups. Early in the pandemic, populations over age 60 represented a greater fraction of total COVID-19 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 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 17, declines in hospital admission rates are evident in all adult age groups, including among the 70+ population which had previously shown plateaus in admission rates (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, suggest similar overall trends in hospital admission rates and also indicate recent declines in total COVID-19 hospital admission rates (rates of first admission and readmissions) in most adult age groups as of late June.

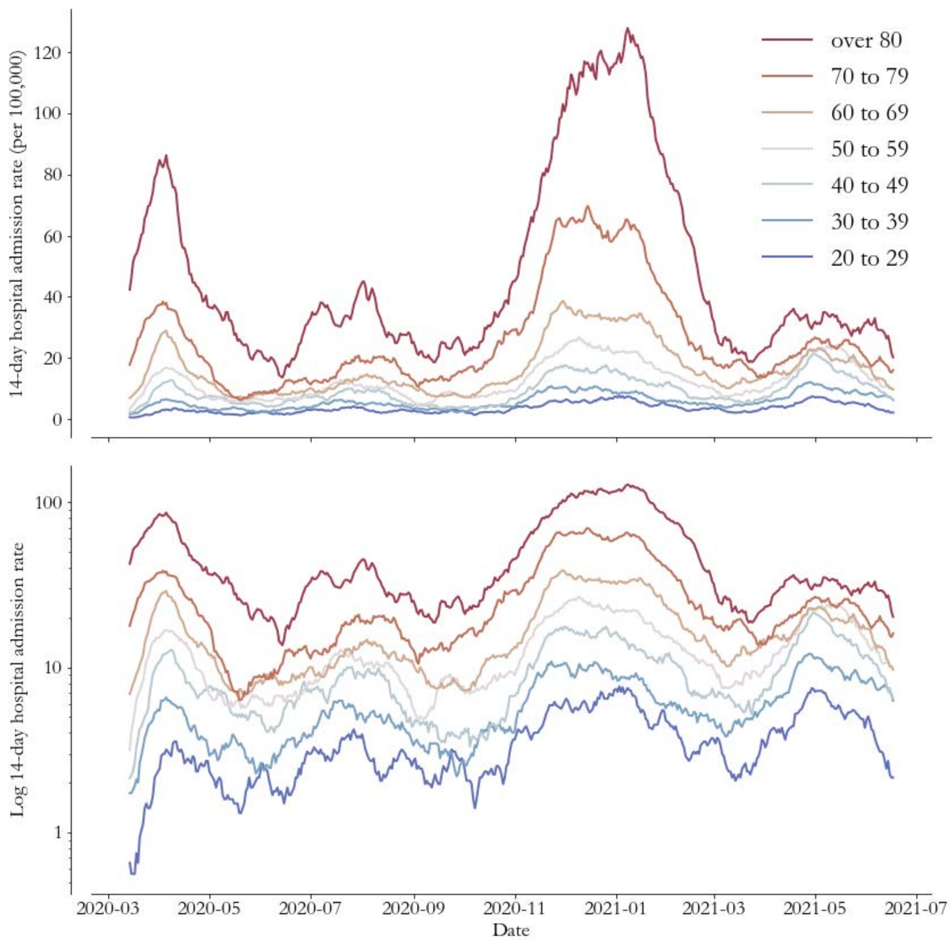
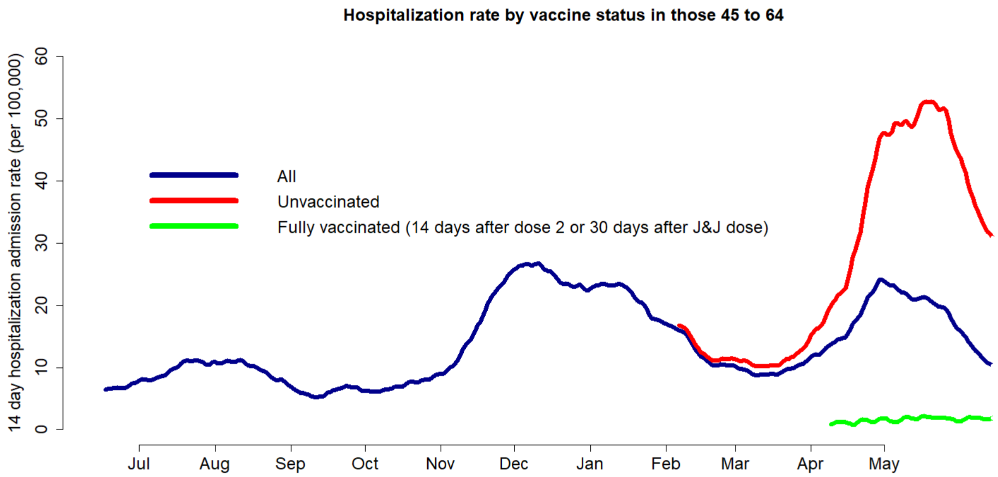


Figure 8. *Statewide 14-day hospital admission rate per 100,000 population by 10-year age group as of June 17. The top panel shows the rates on a standard numeric scale, and the bottom panel shows the rates on a log scale to be able to better compare the rate of decline between age groups that have large differences in rates.*

Trends in hospital admission rates by age group and vaccination status

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 June 12, the 14-day hospital admission rate in unvaccinated individuals aged 45-64 is about 16 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 12 times that in fully protected individuals in this age group. Hospital admission rates overall, and among the unvaccinated, have been declining in both the 45 to 64 and 65+ age groups.



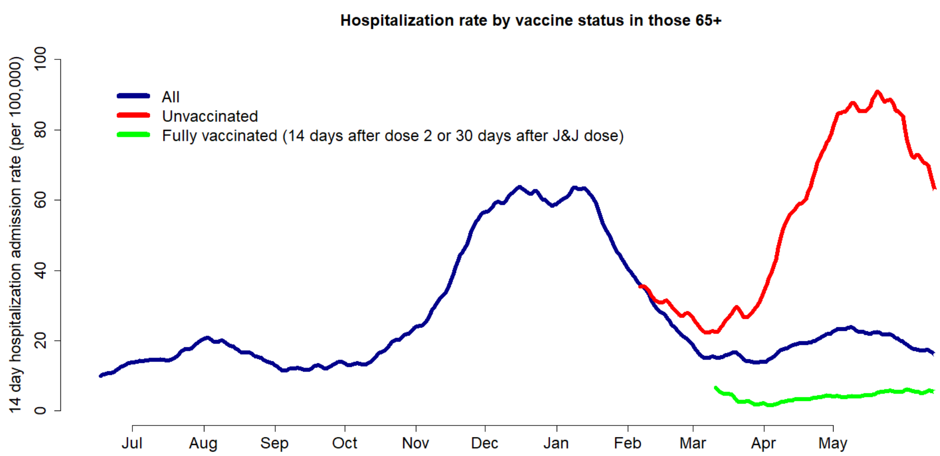


Figure 9. *Comparison of 14-day hospital admission rates between unvaccinated and fully-vaccinated adults age 45-64 (top panel) and 65 and older (bottom panel). Colors represent vaccination status, red = unvaccinated, green = those who are fully protected (14 days after 2nd dose or 30 days after J&J 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, and has been declining since, with slight flattening as of June 26 (Figure 10). Similarly, ICU beds occupied by confirmed or suspected COVID-19 patients increased through early May, remained fairly flat through the end of May, declined sharply in early June, and have been increasing again since mid-June.

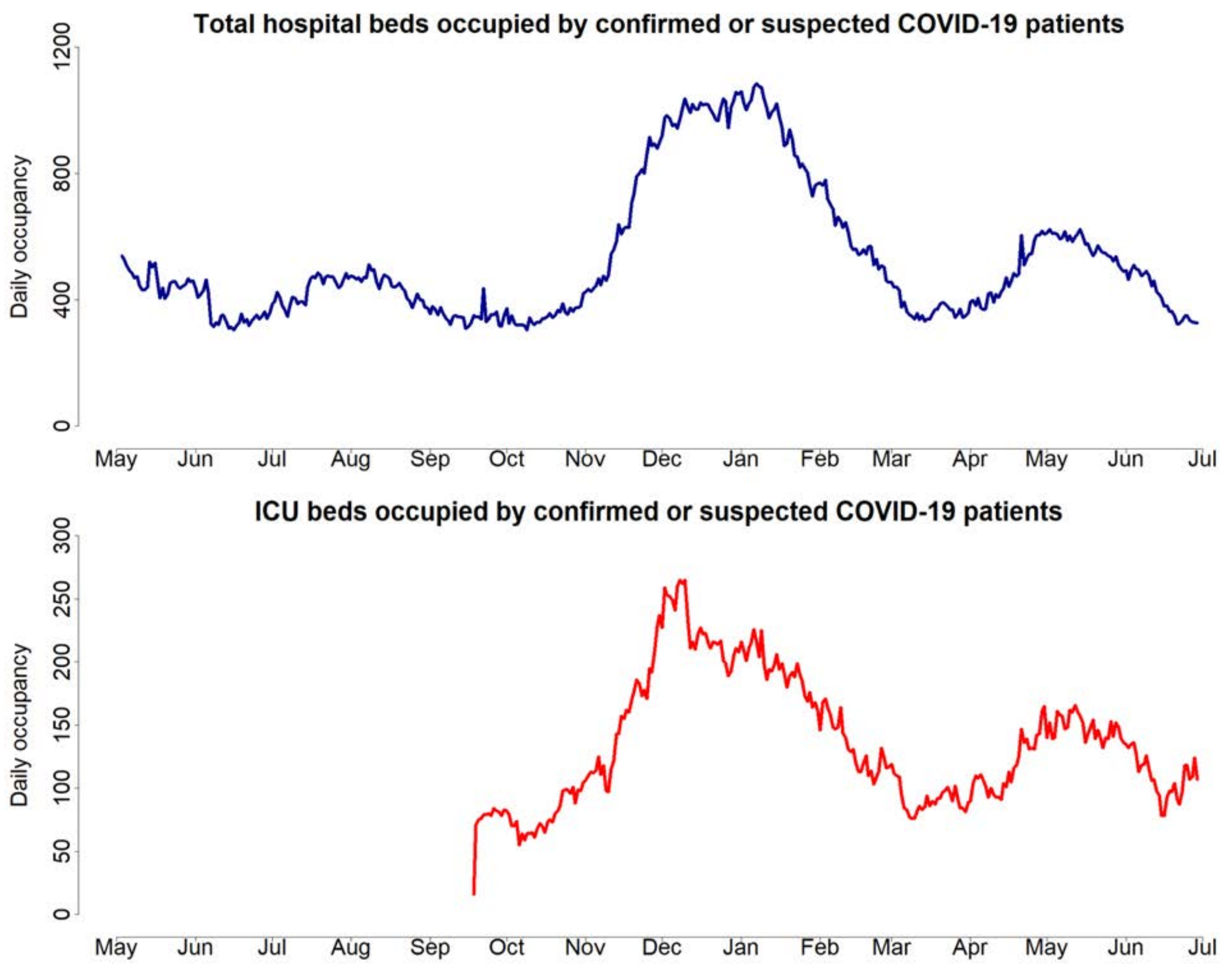


Figure 10. *Total hospital beds and ICU beds occupied by confirmed or suspected COVID-19 patients reported through the WA Health system. Data collection for ICU beds occupied by COVID-19 patients started September 17. Hospital occupancy data has minimal reporting lag, and is shown here using data up to June 26. 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 June 3, and using a multinomial generalized additive model, we estimate that as of June 29, around 24% of cases are attributable to B.1.1.7/alpha, about 30% are due to P.1/gamma, and about 33% are due to B.1.617.2/delta (Figure 11). Based on model extrapolations through June 29, the proportion of cases attributable to B.1.1.7/alpha is declining and the proportion of cases attributable to P.1/gamma is flattening. The proportion of cases attributable to B.1.617.2/delta is currently increasing faster than other variants, and this increase is faster than the overall rate of decrease in total cases. Applying these estimates to the total number of cases, including those not sequenced, reveals that the number of cases of B1.617.2 is likely increasing exponentially, while P1/gamma is likely flat or declining. 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.

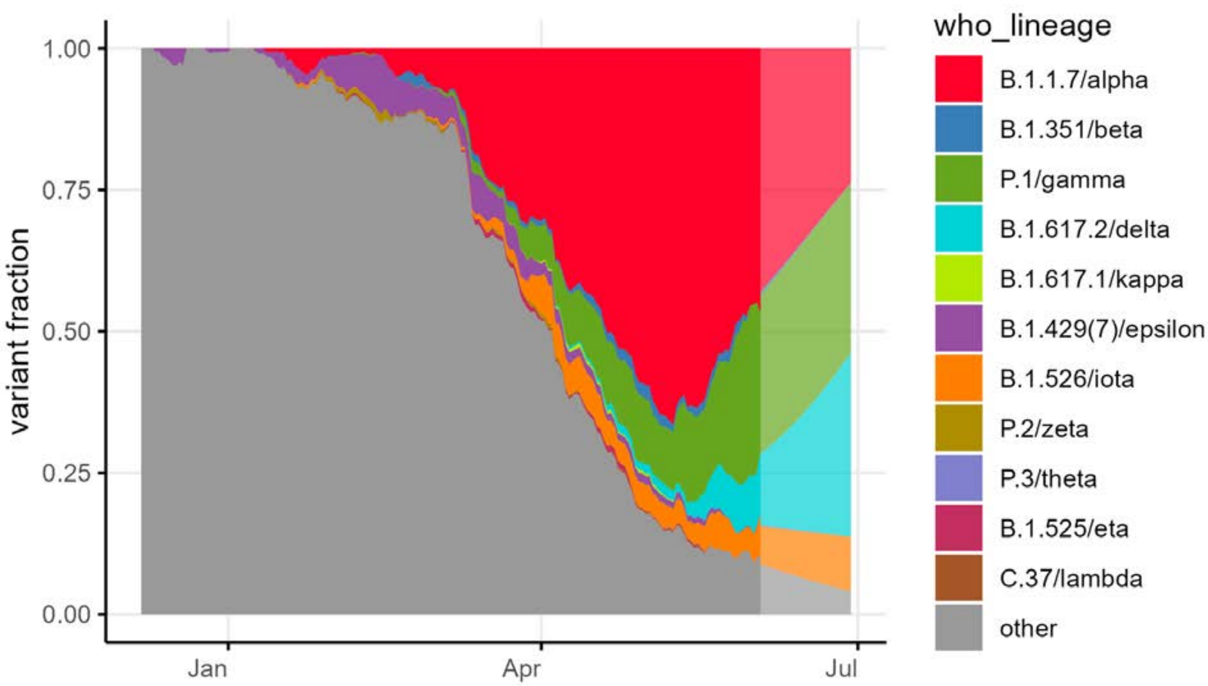


Figure 11. *Estimated fraction of cases attributable to variants of concern in Washington State. Data used in this analysis exclude sequences obtained by targeting B.1.1.7/alpha. This figure shows a seven-day running average through June 3 (darker colors) and then a multinomial growth model nowcast through June 29 (lighter colors). 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 generally declined since May, although the current estimatetotal R_e has remained fairly close to one. Statewide, prevalence has continued to decline since mid-April, and as of June 17 has reached levels below those observed in March. 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 declining across age groups, as are hospital admission rates. While total hospital occupancy due to suspected or confirmed COVID-19 patients have continued to decline, with some flattening in late June, ICU occupancy due to COVID-19 patients has increased in late June. So far, there has not been a major increase in mortality associated with the most recent fourth wave of cases, with deaths varying from 5 to 10 per day. In combination, these data suggest that trends in the state are improving.

Vaccination rates across Washington state have fallen from a high of nearly 70,000 doses/day in late April, to around 19,000 doses/day in late June, reflecting a decline in demand. The proportion of the population protected by vaccine-derived immunity is now almost three times 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 by 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 16 times as high as those in the fully vaccinated population in this age group, and in the 65+ population, hospital admission rates are 12 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 50% of all people are currently fully vaccinated as of June 26 (59% of the population 12+, and 60% of the population 16+). After accounting for the additional time after vaccination to achieve full immunity, we estimate that currently 50% of the population remain susceptible as of June 17.

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. The proportion of cases attributable to the B.1.1.7/alpha variant is declining due to competition from the P.1/gamma and B.1.617.2/delta variants. The B.1.1.7/alpha variant is more transmissible than the ancestral SARS-CoV-2 lineage 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 variant. Recent data from the UK suggest that two doses of the Pfizer vaccine are 88% effective against symptomatic disease due to the B.1.617.2/delta variant two weeks after the second dose, in comparison to 93% effective against the B.1.1.7/alpha variant. These data also indicate that the two-dose Pfizer vaccine is 94% effective against hospitalization due to severe disease from the B.1.617.2/delta variant. Additionally, recent laboratory data suggest that antibodies in sera from individuals immunized with the Moderna vaccine remained effective against both P.1/gamma and B.1.617.2/delta, though with some reduction in neutralizing ability.

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, particularly given the spread of the P.1/gamma and B.1.617.2/delta variants across the state.

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 27, and to hedge against delays in reporting, we analyze data as recent as June 17 across the state for cases and hospital admissions, and as recent as June 7 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.