# COVID-19 transmission across Washington State

Washington State Department of Health
May 5, 2021


**To request this document in another format, call 1-800-525-0127. Deaf or hard of hearing customers, please call 711 (Washington Relay) or email civil.rights@doh.wa.gov.**

**Publication Number 820-114**

**For inquiries about this report from media, contact the Public Information Desk: doh-pio@doh. wa.gov**

# SitRep 32: COVID-19 transmission across Washington State

Gitanjali Singh[1], Ian Painter[1], Mike Famulare[2], Niket Thakkar[2], Juan M. Lavista Ferres[3], Ruth Etzioni[4], Barbra A. Richardson[4,5], Cathy Wasserman[1]

[1]Washington State Department of Health; [2] Institute for Disease Modeling; [3]Microsoft AI For Health; [4]Fred Hutch Cancer Center; [5]University of Washington

***Results as of May 4, 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 April 22. 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 April 22 may have changed. To assess changes, you can review the case, hospitalization and death trends including incomplete data on the Epidemiology Curves tab of the DOH 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 April 22 indicate that COVID-19 transmission is increasing in Washington state. Although immunity has lowered transmission, R-effective remains well above 1 and is increasing as of April 16. Prevalence is increasing and has reached levels similar to the winter surge, however hospital admissions have not increased to the same extent.

**Cases:** Case rates are increasing in all age groups except those 70+, with the sharpest increases in youths and young adults. While case counts statewide show some recent flattening, it is unknown whether this will be sustained or is temporary.

**Hospital admissions:** Hospital admission rates are increasing among younger age groups, but appear to be flattening in the 70+ population. Hospital bed occupancy is increasing.

**Vaccination:** Statewide, vaccination is increasing: over ⅔ of the 65+ population has been fully vaccinated and on average nearly 60,000 doses are administered per day. However, 25% of the 65+ population has not yet initiated vaccination, and nearly 70% of the overall population remains susceptible.

**Variants:** The B.1.1.7 variant, which is more transmissible and potentially poses an increased risk of severe illness, continues to spread across the state. We estimate that over 75% of cases are currently attributable to B.1.1.7. The P.1 variant is also increasing in circulation.

**Public health message:** Current trends indicate the state remains in a fourth surge of infection, with many similarities to early November 2020. With over 70% of the population still susceptible it is critical to vaccinate, maintain firm adherence to masking, social distancing, and avoidance of indoor gatherings.

## *Statewide estimates of the effective reproductive number*

Using data from the Washington Disease Reporting System (WDRS) through April 22, we are presenting two versions of the reproductive number ($R_e$) as of April 16. The orange line and orange-shaded region in Figure 1 below shows estimates of $R_e$ that measure *only* the effects of population-level behavior and SARS-CoV-2 variants on transmission rate. On April 16, this "behavior and variant-based" Re was likely between 1.80 and 2.36 with a best estimate of 2.08. The green line and green-shaded region shows estimates of total Re which includes contributions from behavior, variants, and immunity, either from prior infection or due to vaccination. On April 16, this "total" $R_e$ was likely between 1.27 and 1.66, with a best estimate of 1.46. The divergence between the "behavior and variant-based" and "total" Re estimates began in January and has become more evident over time, due to post-infection immunity from the winter surge of infection, combined with increases in vaccination rates across the state. The growth rate of the epidemic is determined by the total Re, and population immunity is beginning to help control the transmission rate. However, immunity is still not sufficient to counteract behaviors that pose transmission risks as well as circulation of variants with greater transmissibility. To reduce levels of cases and hospitalizations, the total $R_e$ (green line and shaded region) needs to maintain a value substantially below 1 for a sustained period of time through a combination of population behavior (such as masking, social distancing, avoiding indoor gatherings) and immunity (including through vaccination).

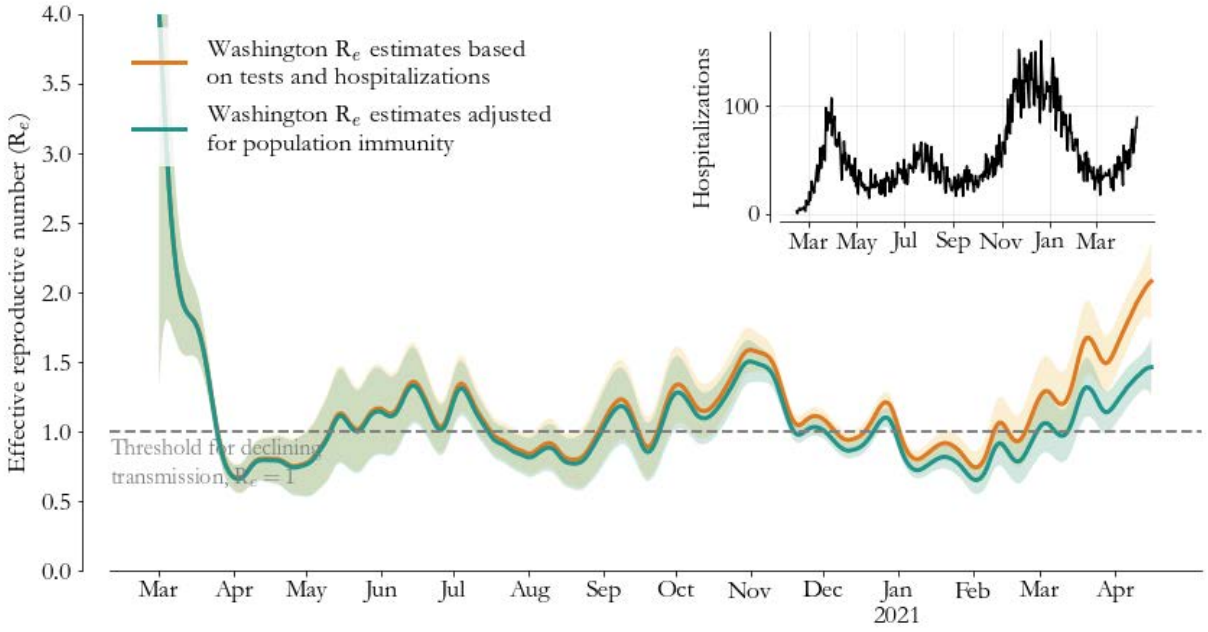


***Figure 1**: estimates for Washington state. The orange line and orange-shaded region indicate the "behavior and variant-based" , while the green line and green-shaded region depict the "total" , which accounts for behavior, variants, and population immunity.*

## *Model-based statewide prevalence*

On April 16, overall prevalence (the percentage of Washington state residents with active COVID-19 infection) in Washington state was likely between 0.38% and 0.67%, with a best estimate of 0.52% (Figure 2). Current prevalence has nearly doubled in comparison to its level on April 2, and the steep rise since early April is similar to that observed in late October of 2020. Prevalence as of April 16 is only slightly lower than the peak prevalence observed in November 2020. However, hospital admissions remain significantly lower than they were in November 2020, likely due to greater current population immunity, largely due to vaccination.

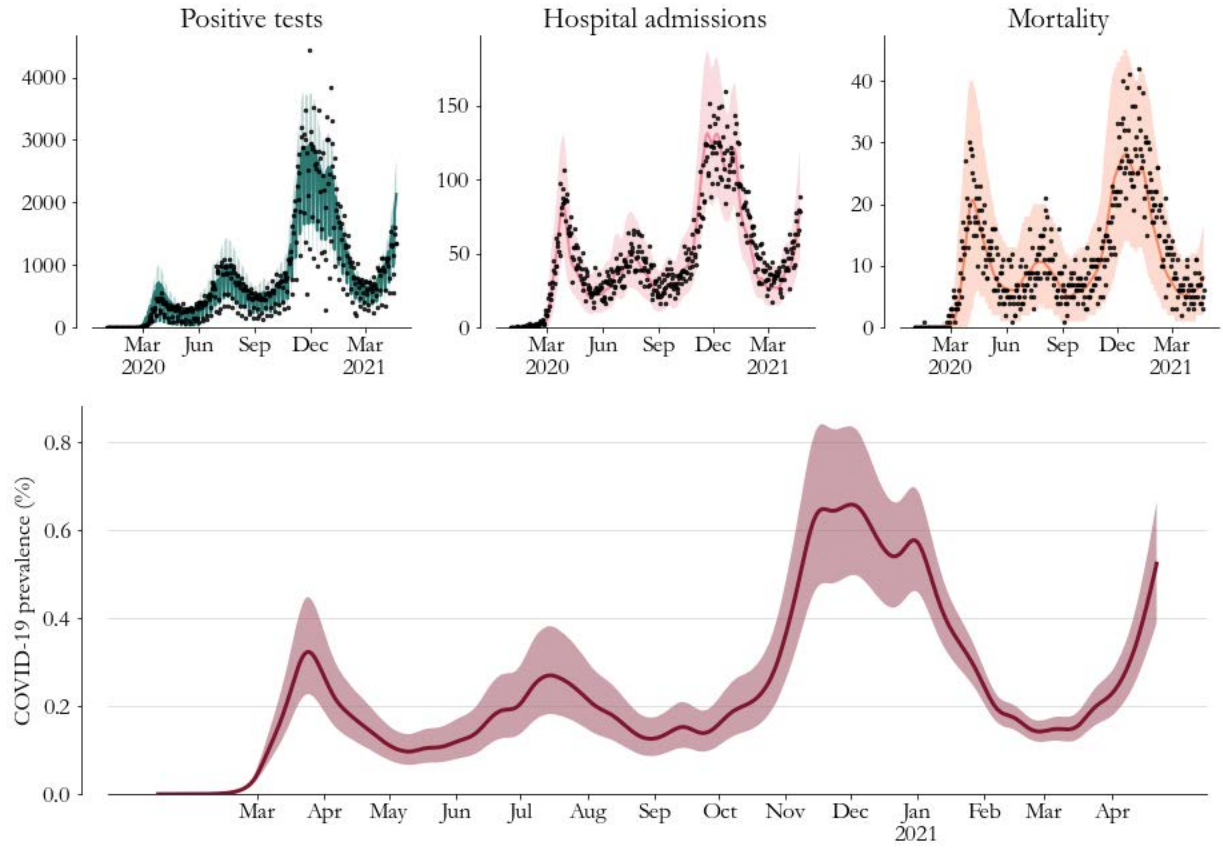


***Figure 2**: Model-based prevalence estimates (bottom, 95% CI shaded) and model fit to cases (top left), hospitalizations (top middle) and deaths (top right) for Washington state. Prevalence is the percentage of Washington state residents with active COVID-19 infection.*

## *Model-based statewide immunity*

On April 16, we estimate that overall population immunity to SARS-CoV-2 in Washington state was between 30.1% and 33.6% with a best estimate of 31.9%. Approximately 12.6% (95% uncertainty interval: 10.4% to 14.9%) of the population derived immunity from prior infection, and about 19.3% (95% uncertainty interval: 18.7% to 19.8%) from vaccination. Figure 3 indicates that currently, vaccine-derived immunity has clearly surpassed naturally-derived immunity at the population level.

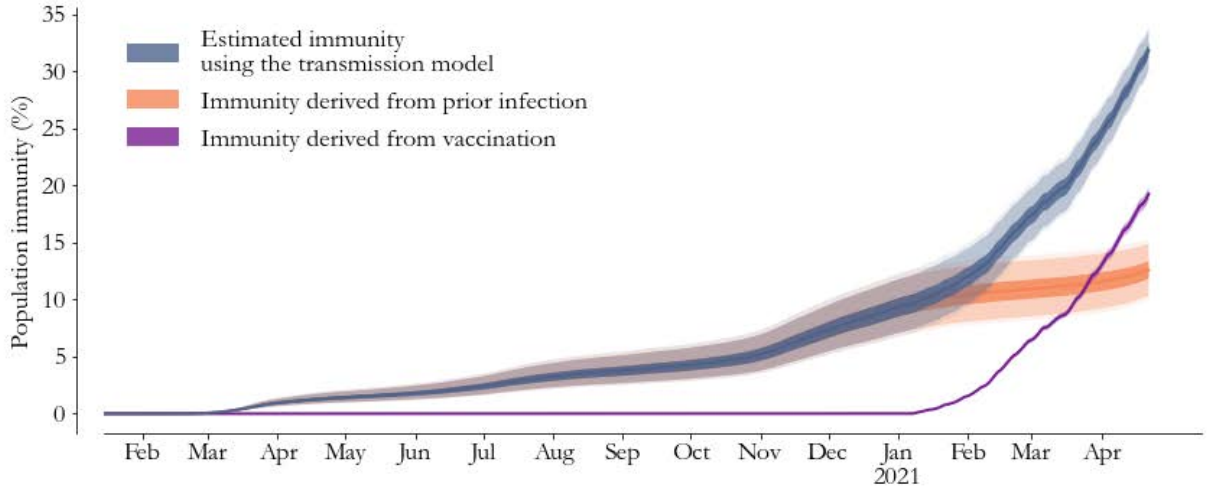


***Figure 3****: Model-based estimates of population-level immunity to SARS-CoV-2 infection as of April 2. Overall population immunity is indicated in the blue line and shaded area. The percent of the population deriving immunity from prior infection, the "natural component," is shown in orange. Note 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. The proportion of the population that derived immunity from vaccination at least 21 days prior is indicated in purple.*

## *Trends in cases, hospital admissions, and deaths*

**Case counts** began increasing in late March, with some recent flattening evident in late April, although it is unclear whether the flattening will be temporary or sustained (Figure 4). The seven-day rolling average case count increased from 384 cases per day on September 12 to the most recent peak of 2913 on January 8, declined to 728 cases per day as of February 15, remained at that level for a month, and has since increased to 1405 cases per day as of April 22.

**Hospital admissions** flattened in early March and began increasing in late March, with continued increase evident through April 22 and in the incomplete data. The seven-day rolling average of hospital admissions increased from 21 per day on September 4 to a peak of 122 on January 6, then declined again to 34 as of March 4, flattened near that level until late March, and has since increased to 77 as of April 22.

**Deaths** continued to decline through late March, and appear to be flattening as of mid-April. The seven-day rolling average of deaths increased from 5 per day on September 12 to a peak of 32 on January 10 and has since declined to 7 as of April 12 (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).

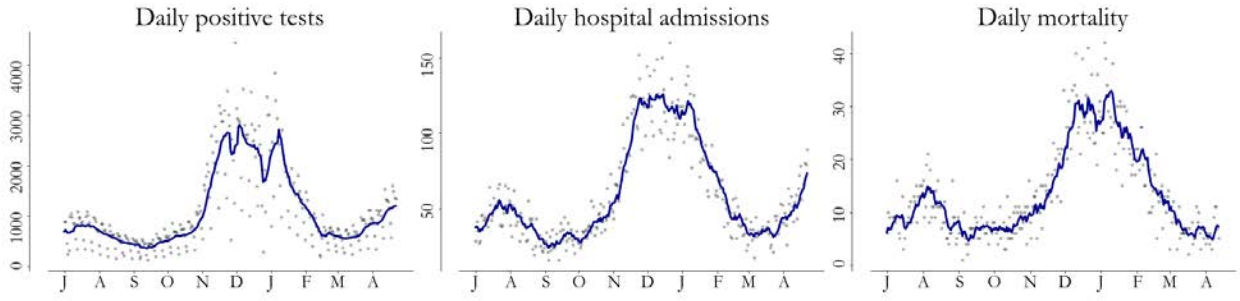


***Figure 4****: Seven-day rolling case counts (left panel), hospital admissions (middle panel) and deaths (right panel) for Washington from July 2020 through April 22 (cases and hospitalizations) and April 12 (deaths) 2021. Because of how confirmed deaths are being reported, we are using an earlier cutoff for the mortality panel.*

## *County-level trends*

Across Washington state as of April 22, 2 counties had no new cases over the prior two weeks (Columbia, Garfield); 13 counties had 14-day rates of new cases between 100 and 200 per 100,000 people; and 10 counties had rates between 200 and 300 per 100,000. 5 counties (Pacific, Franklin, Pierce, Ferry, Lincoln) had rates above 300 per 100K. Trends in county-level case counts show greater variability than in prior weeks--while many counties continue to see increases in counts, quite a few counties are also seeing flattening in case counts:

- Among the five largest counties, case counts in Clark, King, Pierce, and Snohomish appear to be flattening, while case counts in Spokane flattened and have begun to decline.
- Among middle-sized counties, case counts continue to increase in Thurston and Whatcom counties. After increases in April, counts have flattened in Franklin, Skagit, Benton, Grant, and Kitsap counties. Cases are declining in Cowlitz county, and cases in Yakima have remained fairly flat since mid-February.
- Among small counties, case counts in Chelan remain flat, and all other small counties still have fewer than 10 counts per day, on average, but increases are evident in Island, Stevens, Lincoln, and Ferry.

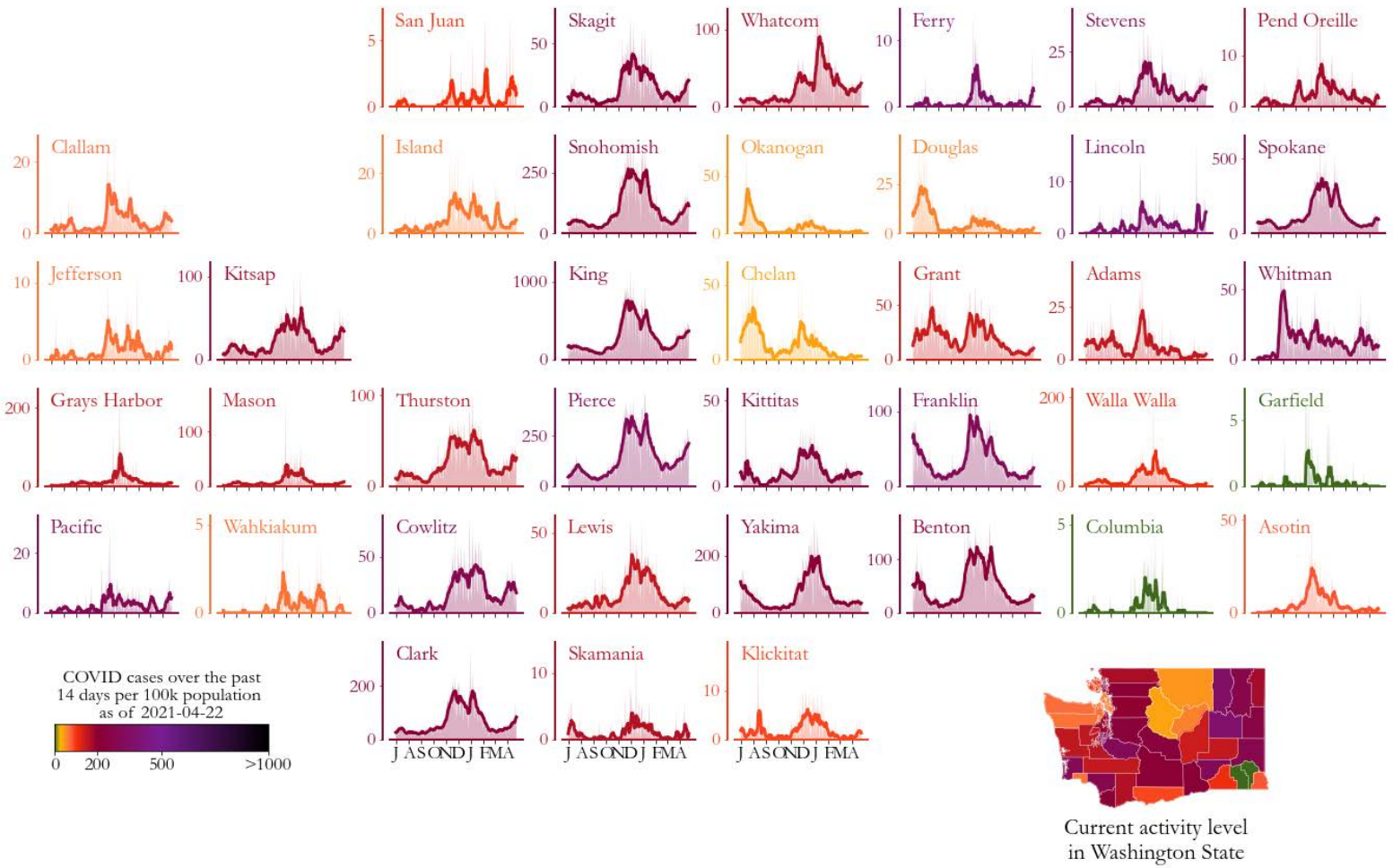


***Figure 5**: Daily COVID-19 positives (shaded areas) and 7-day moving averages (curves) arranged geographically and colored by COVID-19 activity level (total cases from April 9 to April 22 per 100,000 people). Case trends across counties highlight geographic correlations and help us better understand region-level estimates of the transmission rate (see Figure 1).*

## *Trends in case rates by age group*

Across Washington state, the declines in case counts across age groups that began in early January (Figure 6) largely flattened from mid-February to mid-March. As of April 22, case rates (cases per 14-day period per 100,000 people) are increasing in all age groups except for ages 70-79 and 80+. Adults aged 20-29 currently have the highest case rates and are experiencing the sharpest increases in case rates. Sharp increases are also evident for youths aged 10-19 and adults aged 30-39, 40-49, and 50-59. Shallower increases are apparent among children aged 0-9 and adults aged 60-69. Until mid-March, children aged 0-9 consistently had the lowest case rates, but have subsequently surpassed the rates observed in the 60-69, 70-79 and 80+ age groups.

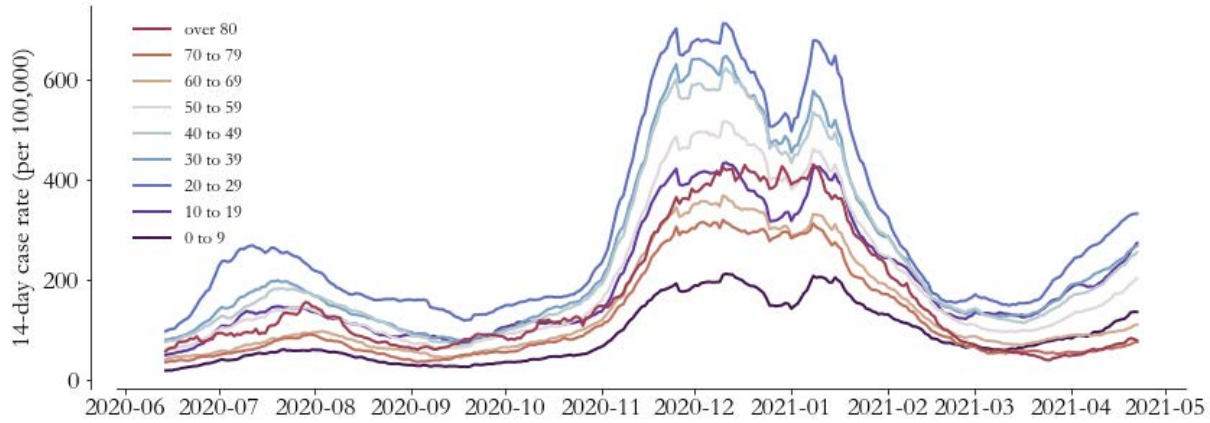


***Figure 6.*** *14-day case rates by 10-year age group across Washington state, as of April 22, 2021.*

In Figure 7, the top panel shows 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. Conversely, the 20-29 year old age group now accounts 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 proportional to the population age distribution.

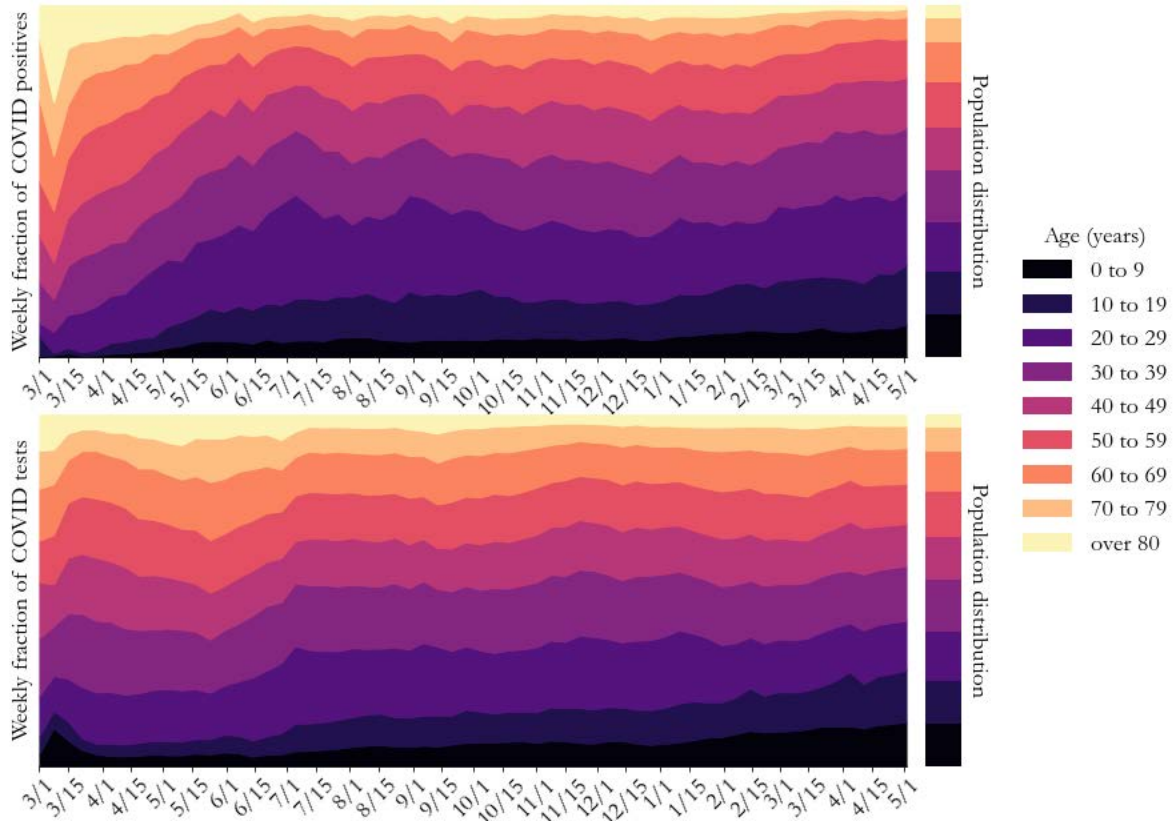


***Figure 7.*** *The top panel of this graph shows the weekly age distribution of COVID-19 cases and the bottom panel shows the weekly age distribution of COVID-19 tests. The colors represent 10-year age groups. Early in the pandemic, populations over age 60 represented a greater fraction of total COVID-19 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 (admissions per 14-day period per 100,000 population) across Washington state began increasing across all age groups in mid-March. These increases have persisted across age groups, except among ages 70-79 and 80+, where some flattening is evident as of April 22 (Figure 8). The sharpest increases in hospital admission rates appear to be among adults aged 20-59. 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 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 further flattening of hospital admission rates in ages 60 and over, as well as slight flattening in the increases among younger ages as of early May. However, it remains to be seen whether those trends are short-term fluctuations or whether they will be sustained over longer time periods.

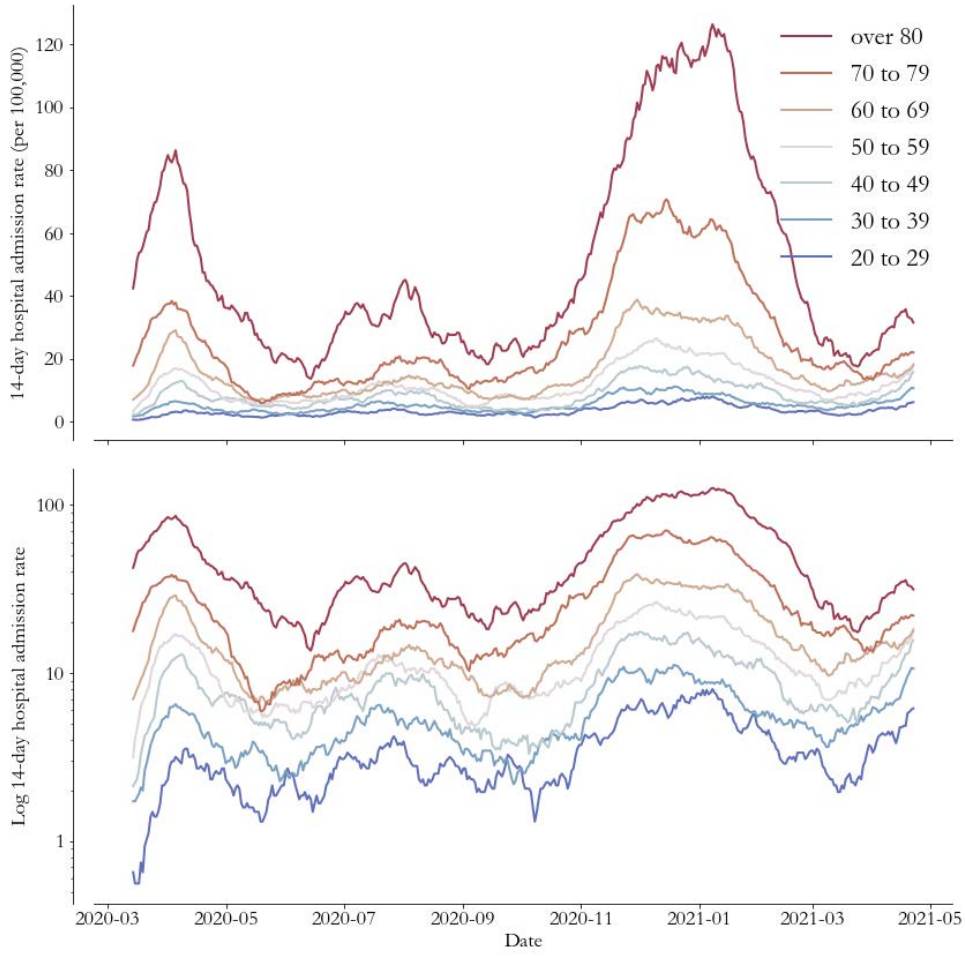


***Figure 8.*** *Statewide 14-day hospital admission rate per 100,000 population by 10-year age group as of April 22. The top panel shows the rates on a standard numeric scale, and the bottom panel shows the rates on a log scale to be able to better compare the rate of decline between age groups that have large differences in rates.*

In order to assess the impact of vaccination on COVID-19 hospital admission rates among adults aged 65 and over, we compared two-week rates of first-time hospital admission between unvaccinated and fully-vaccinated adults in this age group (Figure 9). The hospital admission rate in unvaccinated individuals 65 and older is approximately 9.7 times that in fully protected individuals in this age group (i.e. those who are 14 days after 2nd dose of Pfizer or Moderna vaccines, or 30 days after a Johnson and Johnson dose). Notably, the steep increase in hospital admission rates among the unvaccinated are driving the observed increases in hospital admissions in this age group as of April 12.

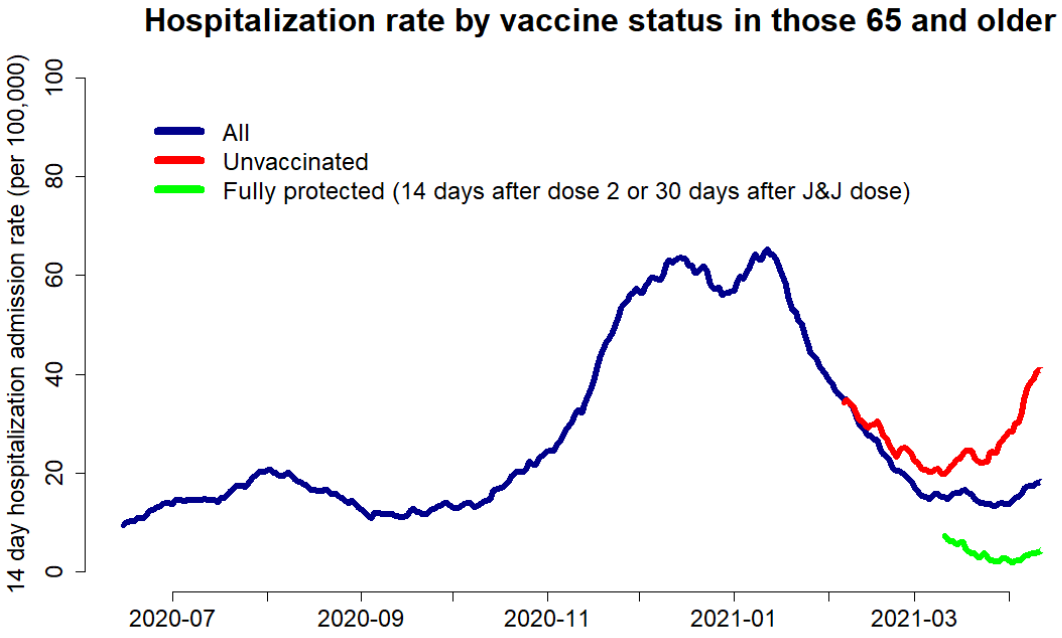


***Figure 9.*** *Comparison of hospital admission rates between unvaccinated and fully-vaccinated adults age 65 and older. Colors represent vaccination status, red = unvaccinated, green = those who are fully protected (14 days after 2nd dose or 30 days after J&J dose), dark blue = overall admission rate 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 rapid increase in the number of occupied hospital beds that started in early November slowed substantially in early December and remained fairly flat until mid-January. Steady declines occurred until mid-March, after which an increasing trend is apparent (Figure 10).
ICU beds occupied by confirmed or suspected COVID-19 patients increased through early December, flattened thereafter, and declined from January until mid-March, at which point an increasing trend is again evident.

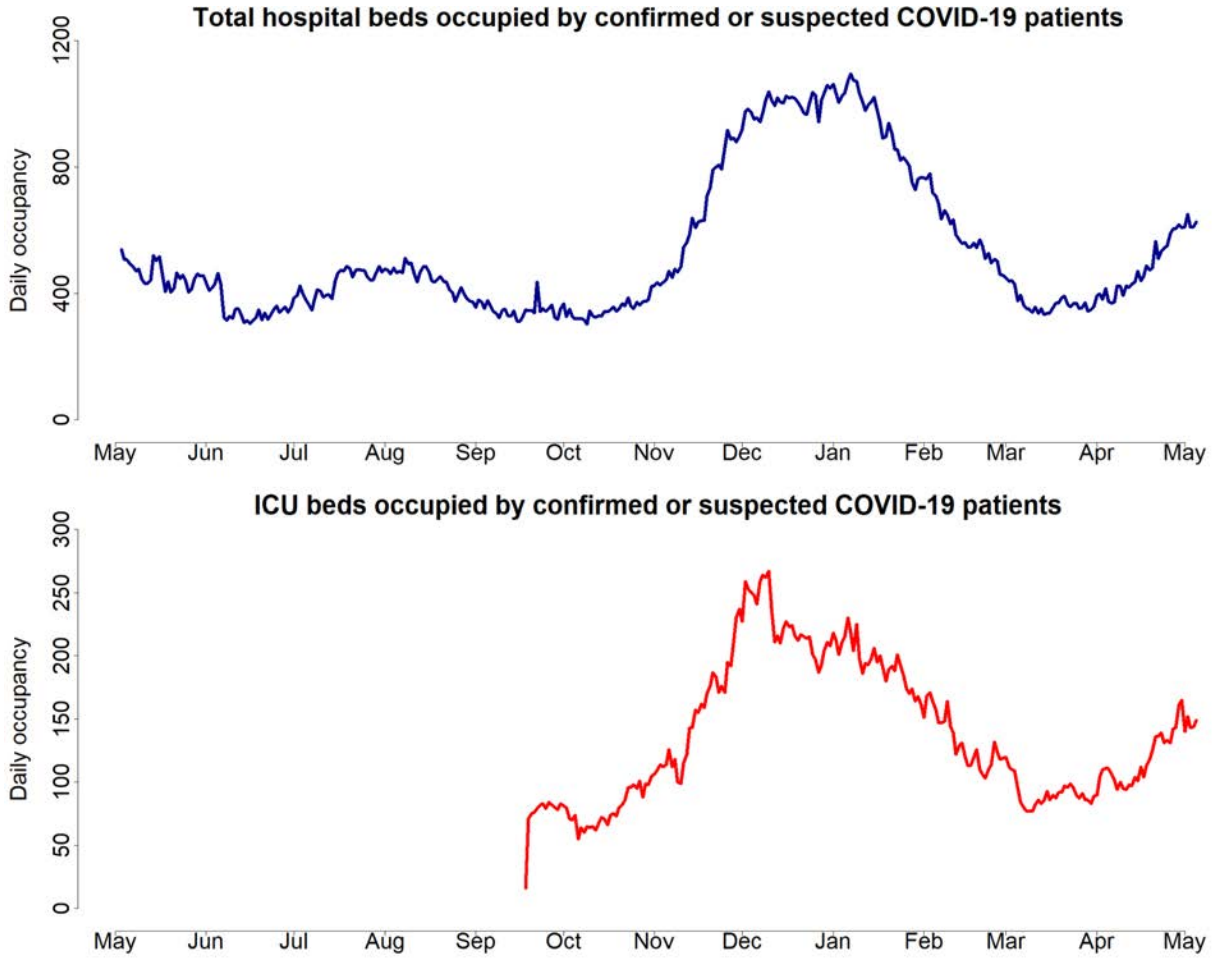


***Figure 10.*** *Total hospital beds and ICU beds occupied by confirmed or suspected COVID-19 patients reported through the WA Health system. Data collection for ICU beds occupied by COVID-19 patients started September 17. Hospital occupancy data has minimal reporting lag, and is shown here using data up to May 1. 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 (VOC) and variants of interest. Extrapolating from data available through April 21, and using a multinomial generalized additive model, we estimate that on May 6, slightly over 80% of cases are attributable to B.1.1.7, and about 10% are due to P.1 (Figure 11). As of mid-May, B.1.1.7 and P.1 will have outcompeted B.1.429(7). This estimation relies on a method that only approximates a representative sample, and results in high uncertainty in these estimates. Nevertheless, this is the most complete picture of the time evolution of SARS-CoV-2 in WA available at this time. A full report of whole genome sequencing of SARS-CoV-2 lineages circulating in Washington state is produced weekly by DOH.

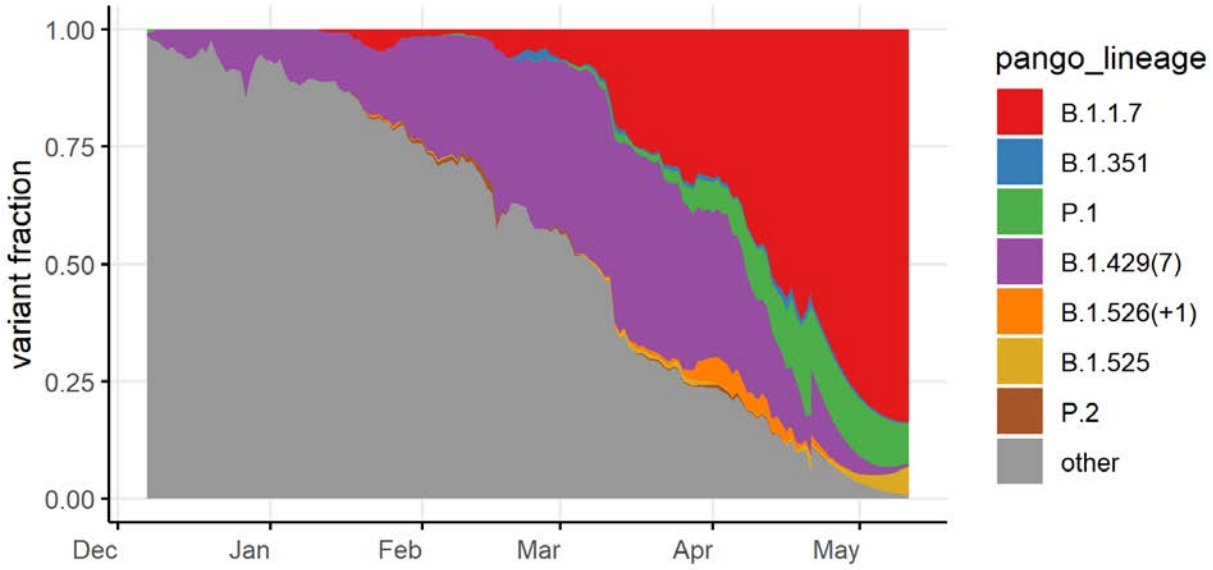


**Figure 11**. *Estimated fraction of cases attributable to variants of concern in Washington State. Data used in this analysis exclude sequences obtained by targeting B.1.1.7. This figure shows a seven-day running average through April 21 and then a multinomial growth model nowcast through May 6. For the figure, variants of interest B.1.427 and B.1.429 have been combined as they are closely related, and similarly for B.1.526 and B.1.526.1.*

## *Implications for public health practice*

Across Washington state, SARS-CoV-2 transmission is increasing, $R_e$ remains above one even after adjusting for population immunity, and prevalence is increasing. Case rates are increasing in all but the oldest age groups, with particularly sharp increases among younger adults and youths. Similarly, sharp increases in hospital admission rates are evident among younger adults. Total beds occupied by COVID-19 patients are also on the increase. Recent trends suggest some flattening in the increasing case counts, both statewide and among the five largest counties, and hospital admission rates may also be flattening among the oldest age groups. However, it is too early to determine whether these flattening trends will be temporary or sustained.

Vaccination rates across Washington state have generally remained steady at around 60,000 doses/day. Beginning in April, the proportion of the population protected by vaccine-derived immunity surpassed the proportion protected by immunity from prior infection, and continues to grow. The steep increases in prevalence that have been observed as of late April have not been accompanied by similarly large increases in hospital admissions as observed in the winter disease surge. This indicates vaccination is likely protecting many people from severe disease. While this is reason to be hopeful, 70% of the overall population remain susceptible. Nearly a quarter of the population over age 65, who are at greatest risk of severe disease and death, have yet to initiate vaccination. Significant county-level variation exists in the proportion of the 65+ population initiating vaccination, ranging from nearly 90% in King county, to roughly 70% in Snohomish, Clark, Pierce, and Spokane counties, to less than 50% in smaller counties such as Garfield, Stevens, Columbia, and Ferry. Our analysis indicates a nearly 10-fold difference in hospital admission rates between vaccinated and unvaccinated persons aged 65+. These protective effects of vaccination against severe disease in the 65+ population in Washington State indicate that significant additional severe disease could be averted with greater vaccine coverage in the 65+ population.

Variants of Concern (VOC) continue to spread across Washington state, and currently, the B.1.1.7 and P.1 VOC comprise the greatest proportion of circulating variants in the state. The B.1.1.7 variant is more transmissible and is linked to more severe disease, but currently available vaccines are protective against it. The P.1 variant is also more transmissible, and may cause more severe disease, but currently available vaccines are less protective against P.1.

In combination, these trends indicate that the state remains in a fourth surge of infection, including rising hospitalizations. While some recent data suggest flattening in case counts statewide, it remains to be seen whether these trends will be sustained over time. With B.1.1.7 above 75% statewide, as well as increasing circulation of P.1, and the majority of the state's population still susceptible, it is clear that continued vaccination and non-pharmaceutical interventions, such as effective masking and social distancing, and implementation of policy levers when needed,

## *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 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 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 May 2, and to hedge against delays in reporting, we analyze data as recent as April 22 across the state for cases and hospital admissions, and as recent as March 12 for deaths.** This relatively conservative hedge against lags is in response to reports of increasing test delays.
- Estimates of 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 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% [(77% to 87% 95% CI]) are protected from SARS-CoV-2 infection 3 weeks 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.