

COVID-19 transmission across Washington State

Washington State Department of Health
August 18, 2021



Washington State Department of
Health

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Publication Number 820-114

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SitRep 38: COVID-19 transmission across Washington State

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Results as of August 17, 2021.

The current Situation Report is based on complete data through August 6. 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 August 6 may have changed. To assess changes, you can review the most up to date picture of 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.

Summary of current situation

Overview: Current model results based on data through August 6 indicate that COVID-19 transmission in Washington state is increasing, with R-effective close to 1.5 as of July 30. Prevalence of COVID-19 has increased sharply over this time period and has reached levels similar to those of the peak late November to January.

Cases: Case counts are increasing sharply through early August statewide, and are increasing in the majority of counties. Case rates are increasing in all age groups.

Hospital admissions: Hospital admissions have increased sharply through August 6, with further increases evident in the incomplete data. These increases are among all adult age groups,. Overall COVID-related hospital occupancy is increasing sharply through August 15, exceeding peak occupancy last winter.

Variants: The B.1.617.2/delta variant maintains predominance.

Public health message: We are likely to see continued increasing cases and hospital admissions in the coming month due to the delta variant. It is essential to continue vaccination to reduce transmission in the long-term. Wear a mask in public indoor settings and crowded outdoor settings, regardless of vaccination status, to prevent current transmission and reduce burdens on the health-care system.

Statewide estimates of the effective reproductive number

Using data from the [Washington Disease Reporting System](#) (WDRS) through August 6, we are reporting the effective reproductive number (R_e) as of July 31. 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 July 31, R_e was likely between 1.32 and 1.67, with a best estimate of 1.49. R_e increased sharply in early July, reflecting rapidly increasing transmission across the state due to the delta variant. The drop in R_e towards the end of July reflects a slight reduction in the steepness of the rate of increase in hospital admissions, however, transmission is still increasing exponentially. To reduce levels of cases and hospitalizations, total R_e needs to maintain a value substantially below 1 for a sustained period of time. Achieving this will require a combination of a high level of vaccination and widespread adoption of behaviors that reduce transmission including wearing masks in public indoor settings and crowded outdoor settings, regardless of vaccination status.

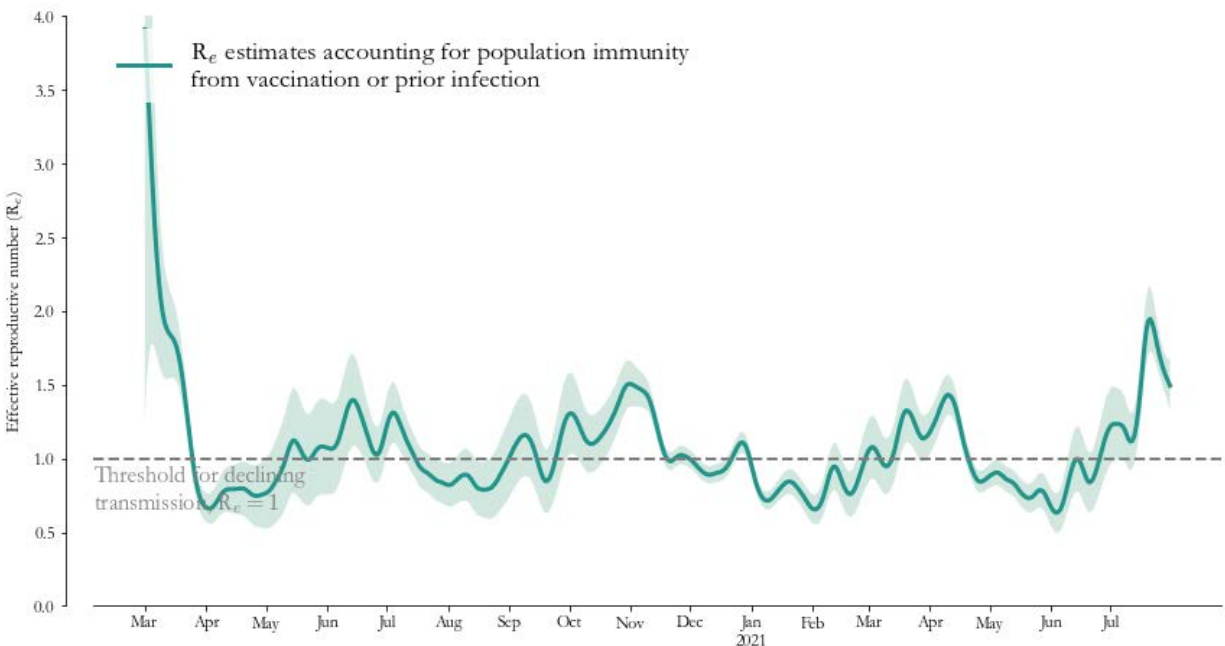


Figure 1: R_e estimates for Washington state. The green line and green-shaded region depict the “total” R_e , which accounts for behavior, variants, and population immunity.

Model-based statewide prevalence

On August 6, overall prevalence (the percentage of Washington state residents with active COVID-19 infection) in Washington state was likely between 0.38% and 0.98%, with a best estimate of 0.64% (Figure 2). This translates to 1 in 156 WA residents currently estimated to have an active COVID-19 infection (symptomatic and asymptomatic). Prevalence has been increasing steadily since the beginning of July, with particularly steep increases in mid-July through early August. As of August 6, prevalence levels were on par with those seen in the peak of the third wave of infection in the winter of 2020.

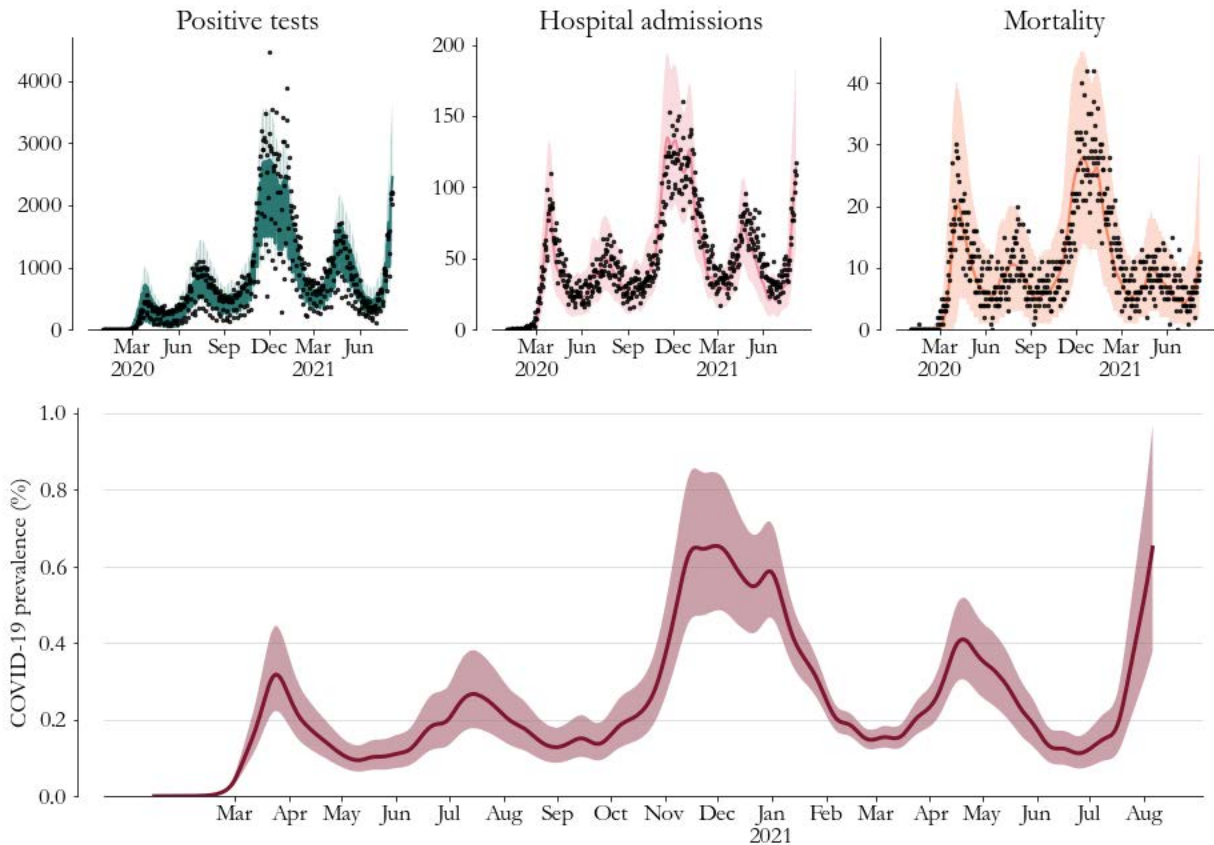


Figure 2: Model-based prevalence estimates (bottom, 95% CI shaded) and model fit to cases (top left), hospitalizations (top middle) and deaths (top right) for Washington state. Prevalence is the percentage of Washington state residents with active COVID-19 infection.

Model-based statewide immunity

On August 6, we estimate that overall population immunity to SARS-CoV-2 in Washington state was between 53.9% and 55.5%, with a best estimate of 54.7%. (Figure 3). Immunity derived from vaccination was around 39.2% (95% uncertainty interval: 38.1% to 40.3%), and immunity derived from prior infection was around 15.5% (95% uncertainty interval: 13.8% to 17.1%). The increase in vaccine-derived immunity and parallel increase in total immunity that began in February has slowed considerably starting in June.

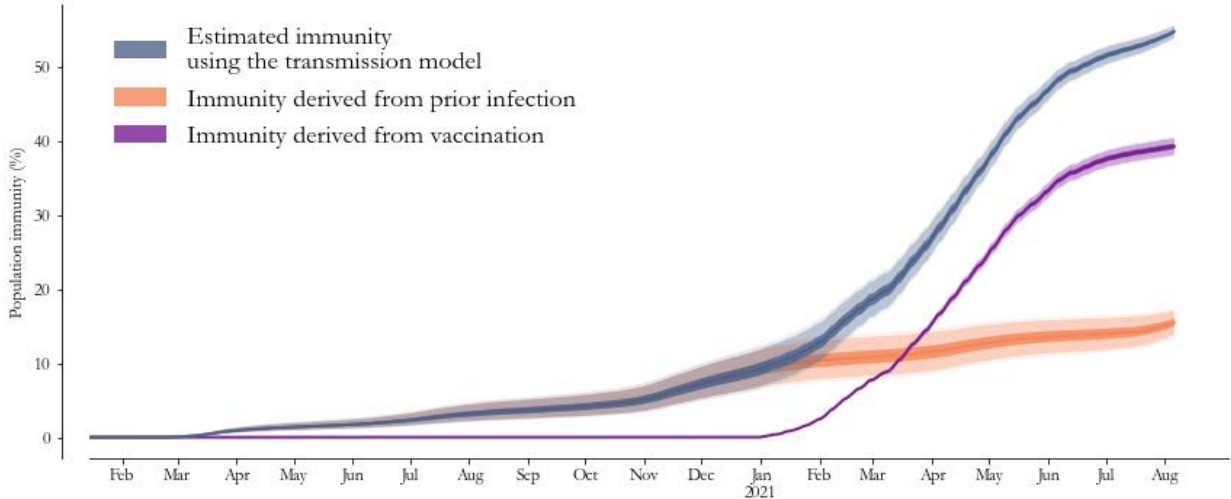


Figure 3: Model-based estimates of population-level immunity to SARS-CoV-2 infection as of August 6. Overall population immunity is indicated in the blue line and shaded area. The percent of the population deriving immunity from vaccination at least 14 days prior is shown in purple, and the percent deriving 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 increased sharply since early July. The seven-day rolling average case count declined from a peak of 2941 on January 8 to 744 cases per day as of February 15, remained at that level for a month, increased to 1519 cases per day as of April 23, declined to 375 as of July 3 and increased to 2262 as of August 6 (a six-fold increase in cases between July 3 and August 6).

Hospital admissions also started increasing in early July. 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 84 as of April 27, declined to a low of 29 as of June 16, and flattened at around 30 through July 8, and increased to 96 as of Aug 6. Increases in hospitalizations continue in the incomplete data subsequent to August 6.

Deaths have remained fairly flat, with some variability, since late March. The seven-day rolling average of deaths declined from a peak of 32 on January 10 to 5 as of March 23, and has varied at between 5 and 10 deaths per day since then, and is currently at 6 as of July 30 (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).

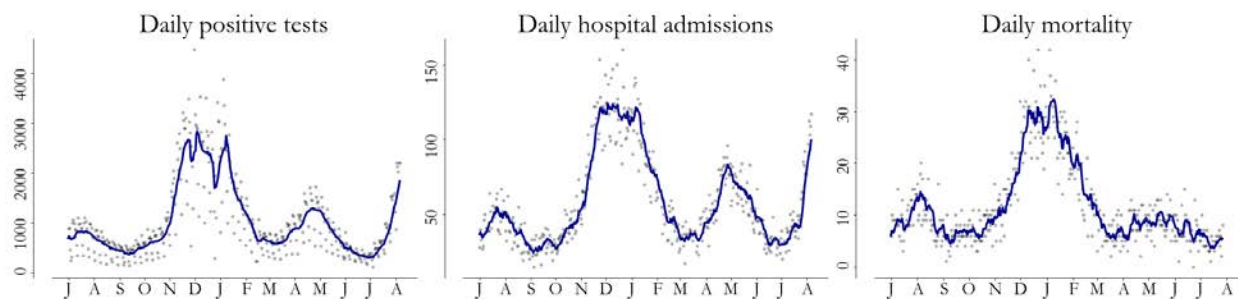


Figure 4: Seven-day rolling case counts (left panel), hospital admissions (middle panel) and deaths (right panel) for Washington from July 2020 through August 8 (cases and hospitalizations) and July 30 (deaths) 2021. Because of how confirmed deaths are being reported, we are using an earlier cutoff for data on daily mortality.

County-level trends

Case rates: Across Washington state as of August 6 (Figure 5a):

- 12 counties had 14-day rates of new cases between 100 and 200 per 100,000 people
- 16 counties had rates between 200 and 300 per 100,000 people.
- 5 counties (Pierce, Spokane, Pacific, Asotin, Lewis) had rates between 300-500 per 100,000.
- 4 counties (Walla Walla, Cowlitz, Benton, Franklin) had cases over 500 per 100,000.
- Case rates have increased sharply in most counties over the month of July (Figure 5b).

Case counts: County-level case counts indicate that the majority of counties (33/39) were experiencing increasing counts as of August 6 (Figure 5a) :

- All of the five largest counties (Clark, King, Pierce, Snohomish, Spokane) show increasing counts as of August 6.
- All middle-sized counties (Benton, Franklin, Cowlitz, Grant, Kitsap, Skagit, Thurston, Whatcom and Yakima) are seeing increasing case counts through August 6.
- Among small counties, counts are increasing in Chelan, Clallam, Douglas, Island, Lewis, Stevens, Walla Walla. All other small counties have fewer than 10 cases per day, but increases are evident in Kittitas, Mason, Whitman, Adams, Asotin, Jefferson, Klickitat, Lincoln, Pacific, Pend Oreille, Columbia, and San Juan counties.

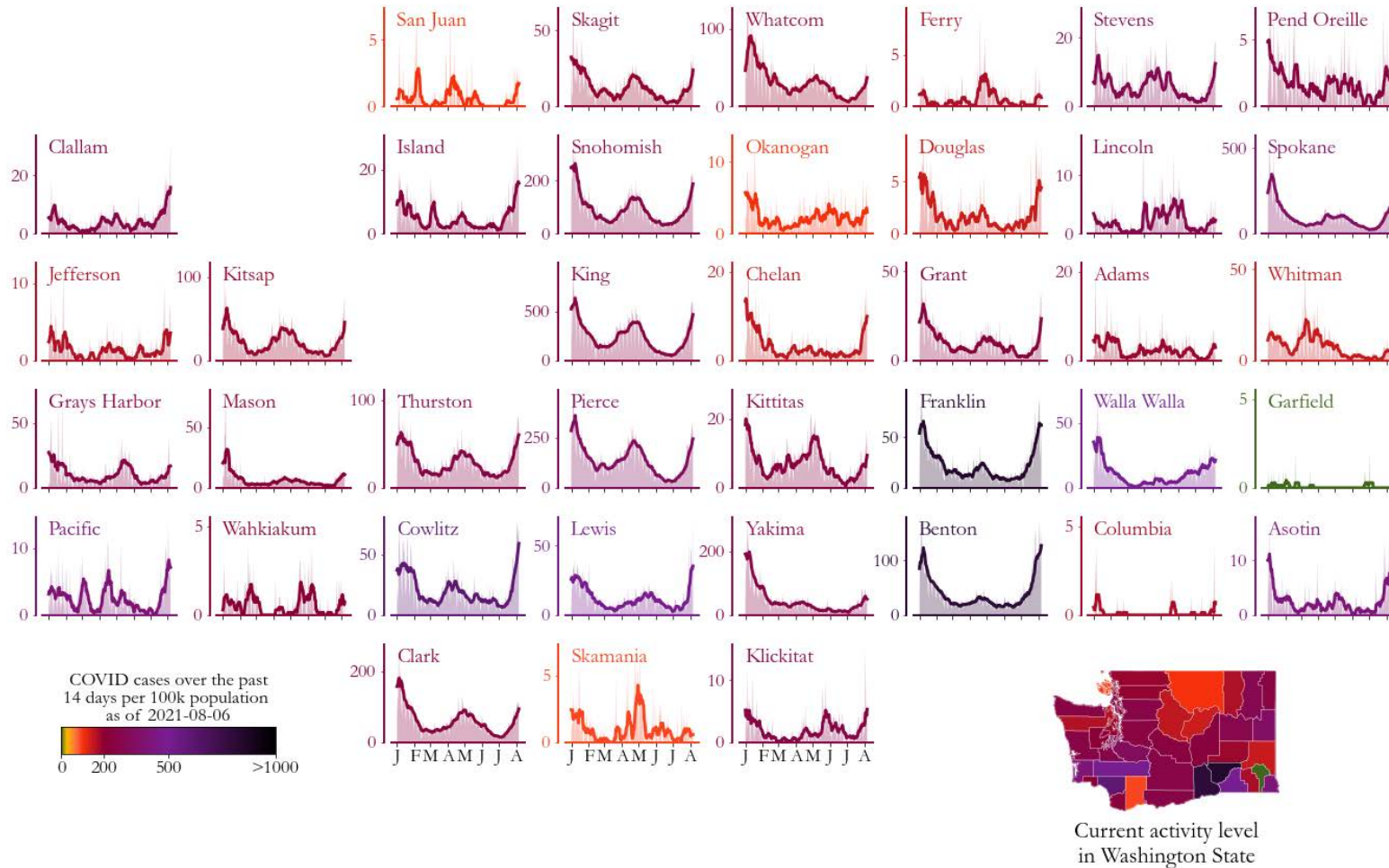
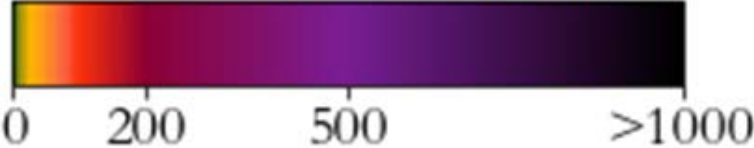
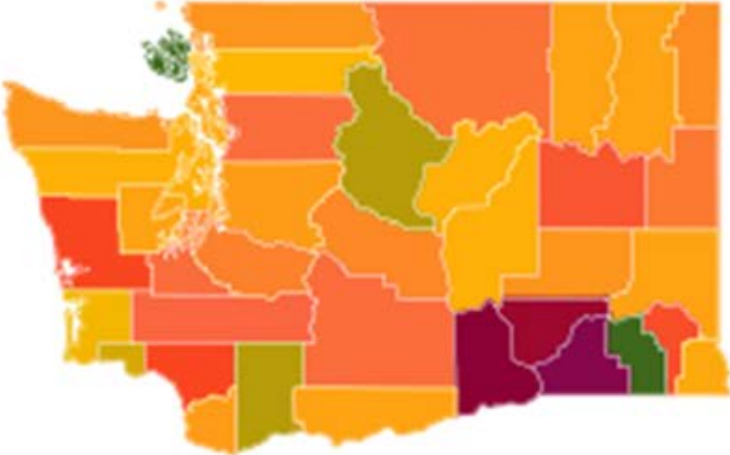


Figure 5a: Daily COVID-19 positives (shaded areas) and 7-day moving averages (curves) arranged geographically and colored by COVID-19 activity level (total cases from July 24 to August 6 per 100,000 people). Case trends across counties highlight geographic correlations and help us better understand region-level estimates of the transmission rate (see Figure 1).

COVID-19 cases per 100,000 people



Two weeks ending on July 8



Two weeks ending on August 6

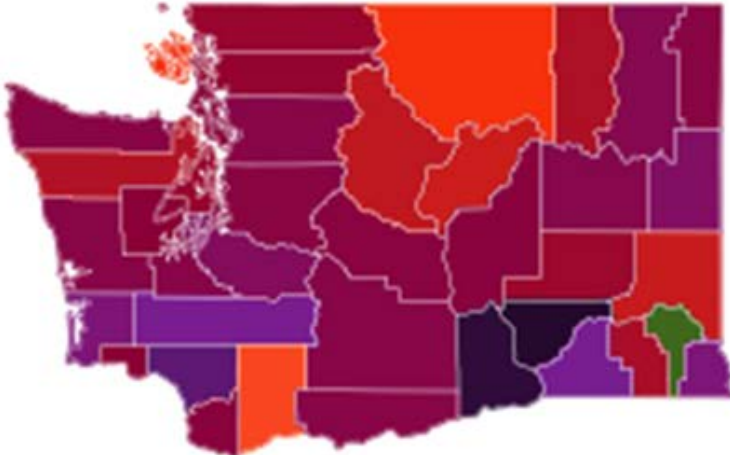


Figure 5b: 14-day COVID-19 case rates (cases per 100,000 people) by county over two time periods, the two-week period ending on July 8 (left), and the two-week period ending on August 6 (right).

Trends in case rates by age group

Across Washington state, 14-day case rates (cases per 14-day period per 100,000 people) have increased sharply in all age groups from early July through August 6 (figure 6). The 0-9 and 10-19 age groups are shown in a separate plot for improved visibility.

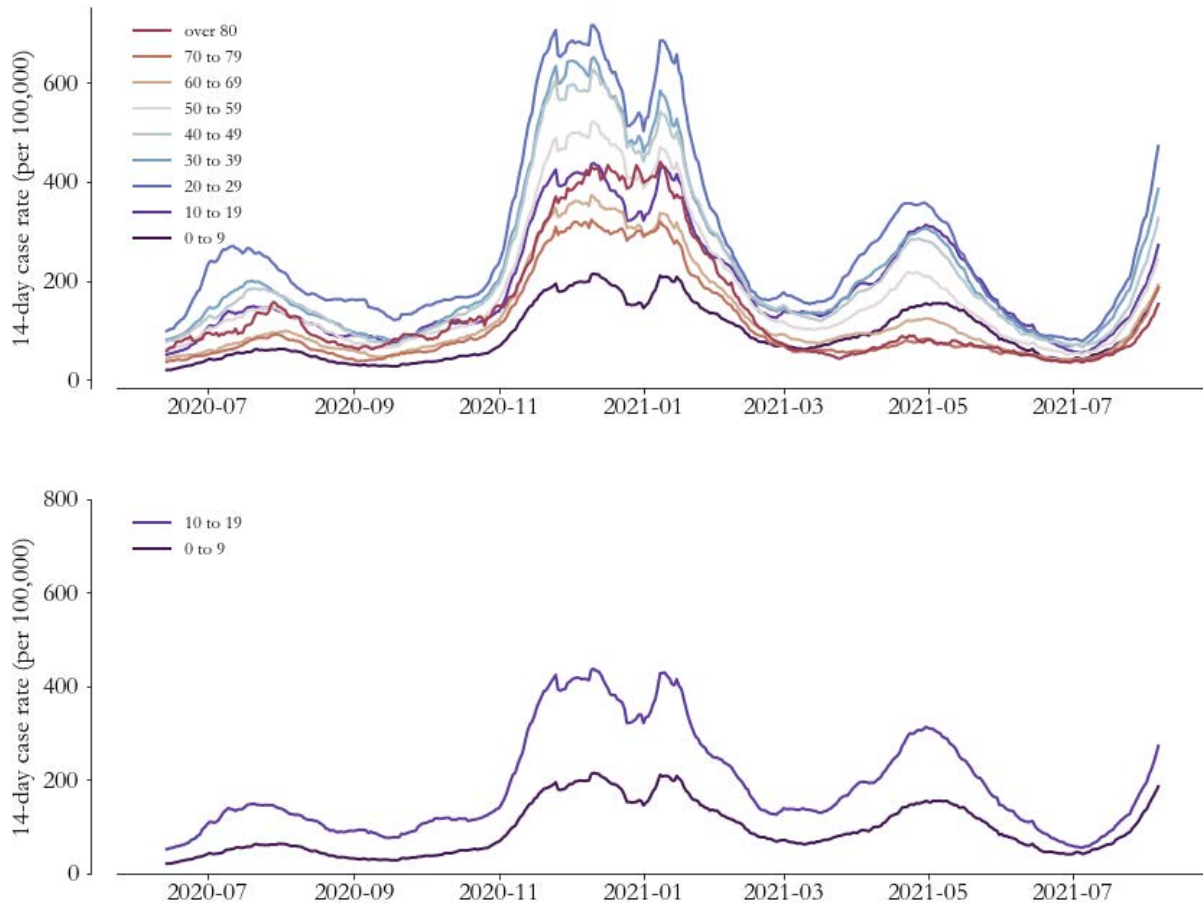


Figure 6. 14-day case rates by 10-year age group across Washington state, as of July 8, 2021. The upper panel shows rates by 10-year age group for all ages 0-80+. The bottom panel shows the rates separately for the 0-19 population.

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 and 30-39 year old age groups now 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, though there have been increases in the proportion of 20-39 year olds getting tested in August.

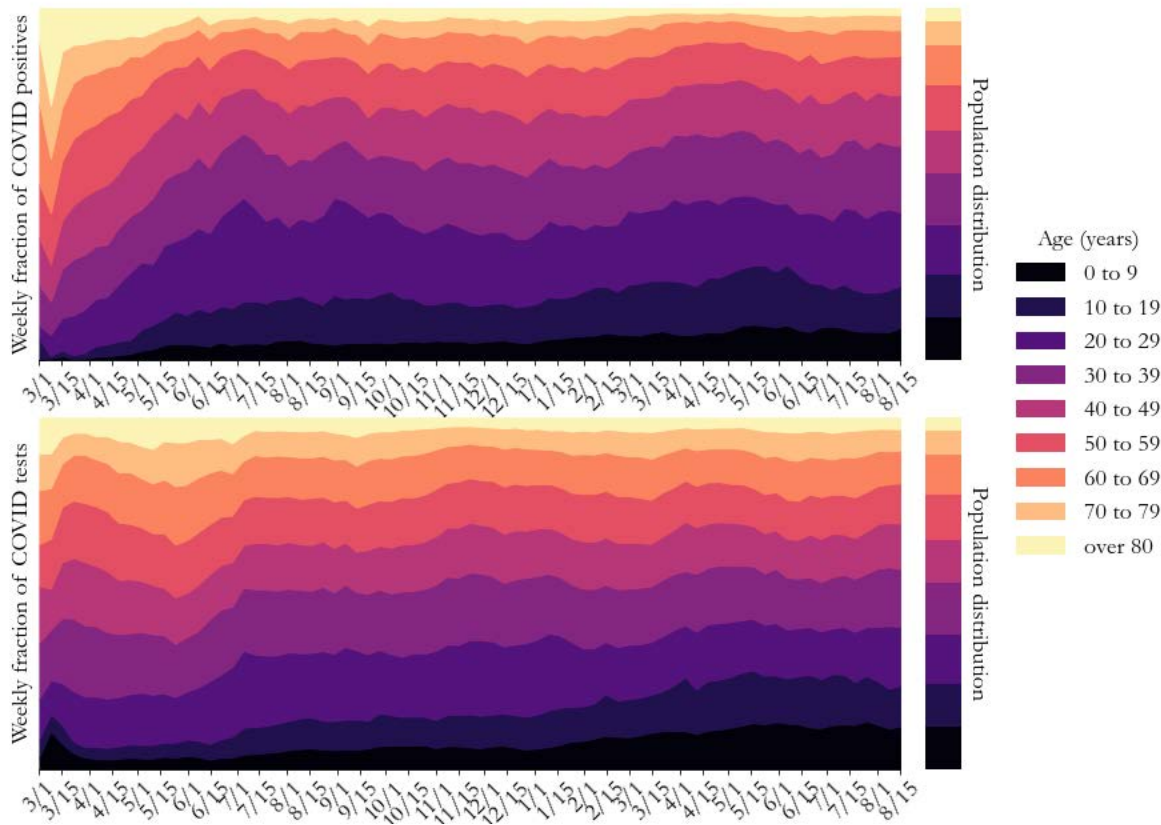


Figure 7. The top panel of this graph shows the weekly age distribution of COVID-19 cases and the bottom panel shows the weekly age distribution of COVID-19 tests. The colors represent 10-year age groups. Early in the pandemic, populations over age 60 represented a greater fraction of total COVID-19 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 in early July. As of August 6, increases in hospital admission rates are evident in all age groups 20 and above (Figure 8). Admission rates for ages 0-19 remain low with large variability, making trends difficult to interpret in this population.

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, show continued increases in hospital admissions in several adult age groups, with some signs of flattening at high rates for ages 30-49, and 60+ as of August 15 .

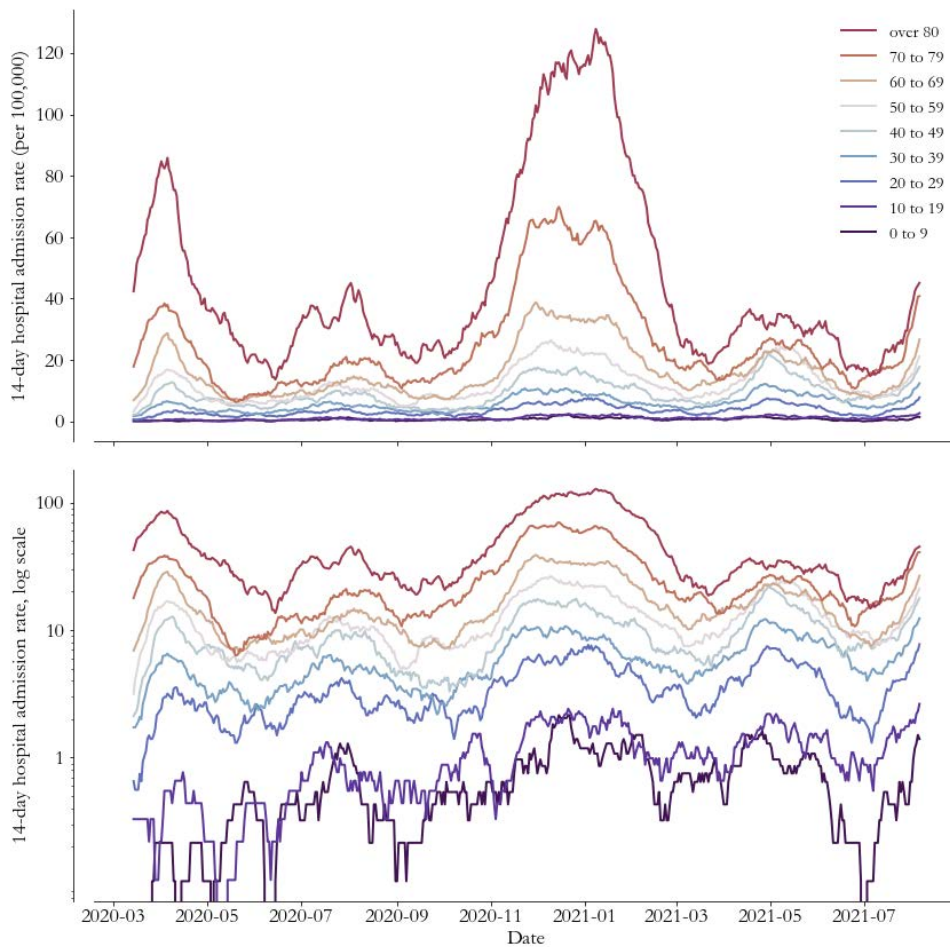


Figure 8. Statewide 14-day hospital admission rate per 100,000 population by 10-year age group as of August 6. The top panel shows the rates on a standard numeric scale, and the bottom panel shows the rates on a log scale to be able to better compare the rate of decline between age groups that have large 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 three age groups, ages 16-44, 45-64 and 65+ (Figure 9). For the two week period ending on July 31, the 14-day hospital admission rate in unvaccinated individuals aged 16-44 is about 10 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 14 days after a Johnson & Johnson dose). The hospital admission rate in unvaccinated individuals 45-64 is also approximately 10 times that in fully protected individuals in this age group, and the hospital admission rate is approximately six times higher in the unvaccinated 65+ population. Hospital admission rates overall, and among the unvaccinated, have increased in all age groups, with particularly sharp increases among the unvaccinated.

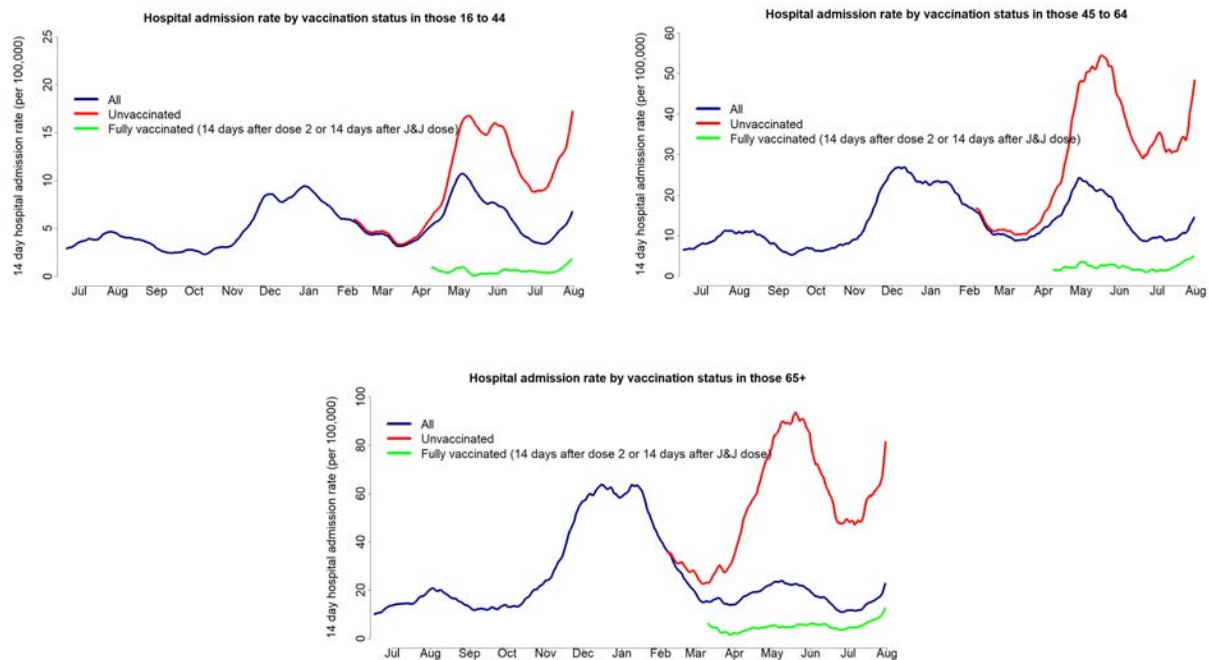


Figure 9. Comparison of 14-day hospital admission rates between unvaccinated and fully-vaccinated adults age 16-44 (top panel), 45-64 (middle panel), and 65 and older (bottom panel). Colors represent vaccination status, red = unvaccinated, green = those who are fully protected (14 days after 2nd dose 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 total hospital beds (Figure 10, top panel) and ICU beds (Figure 10, bottom panel) occupied by confirmed or suspected COVID-19 patients increased sharply starting in mid-July, with levels now exceeding those observed during the peak of the third wave of infection in winter 2020. COVID-19 occupancy levels from 8/5/2021 - 8/11/2021 have surpassed state goals (no more than 10% of staffed acute care beds and no more than 20% of staffed ICU beds occupied by COVID-19 patients) for adequate hospital readiness.

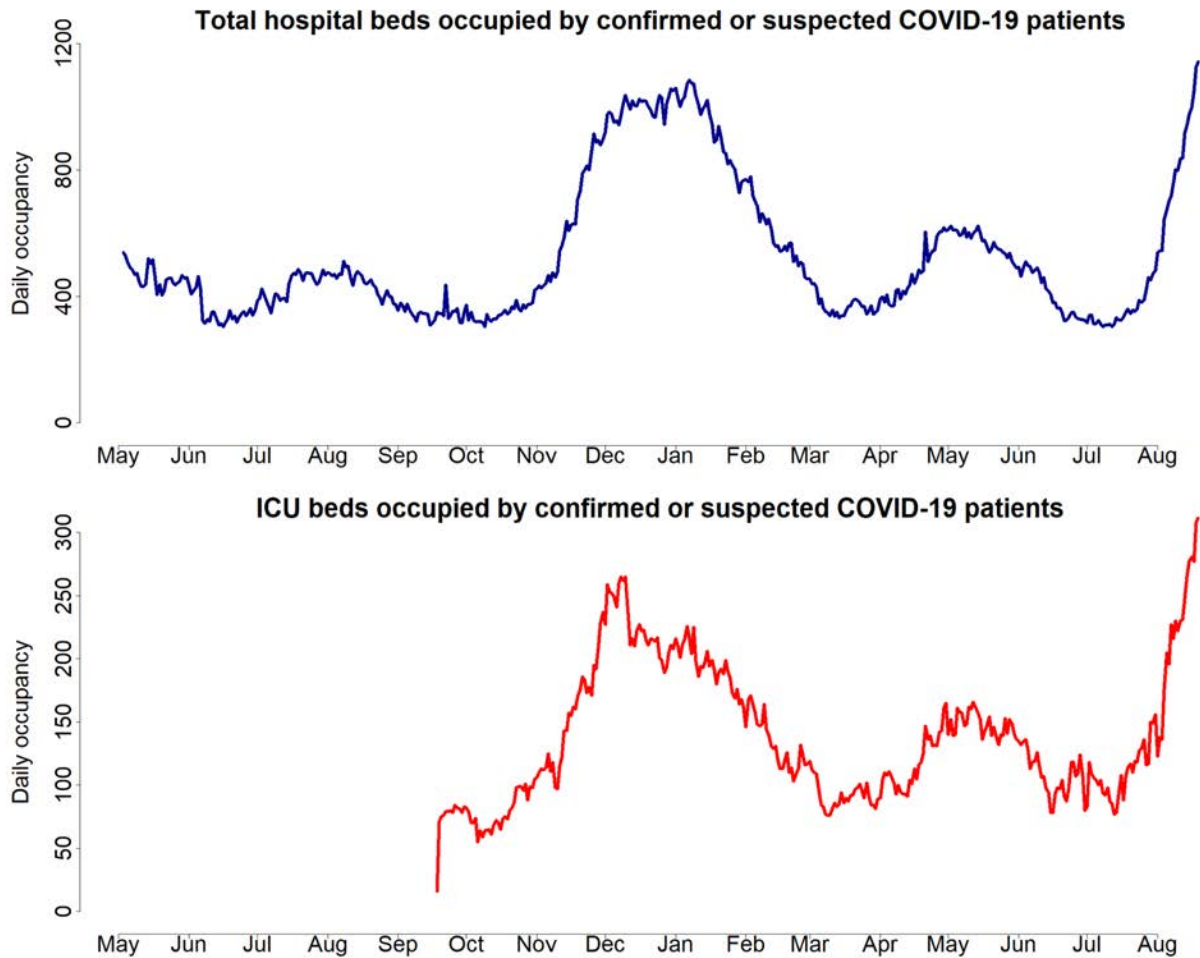


Figure 10. Total hospital beds and ICU beds occupied by confirmed or suspected COVID-19 patients reported through the WA Health system. Data collection for ICU beds occupied by COVID-19 patients started September 17. Hospital occupancy data has minimal reporting lag, and is shown here using data up to August 15. Both confirmed and suspected cases are included, rather than just confirmed cases, since this best reflects total resources being used. Note that bed occupancy will increase faster than admissions 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 July 31, and using a multinomial generalized additive model, we estimate that as of August 16, less than 1% are due to P.1/gamma and B.1.1.7/alpha, and about 98% are due to B.1.617.2/delta (Figure 11). Applying these estimates to the total number of cases, including those not sequenced, reveals that the number of cases of B.1.617.2/delta continues to increase exponentially. There is considerable uncertainty in these projected estimates due to the use of a method that only approximates a representative sample. 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.

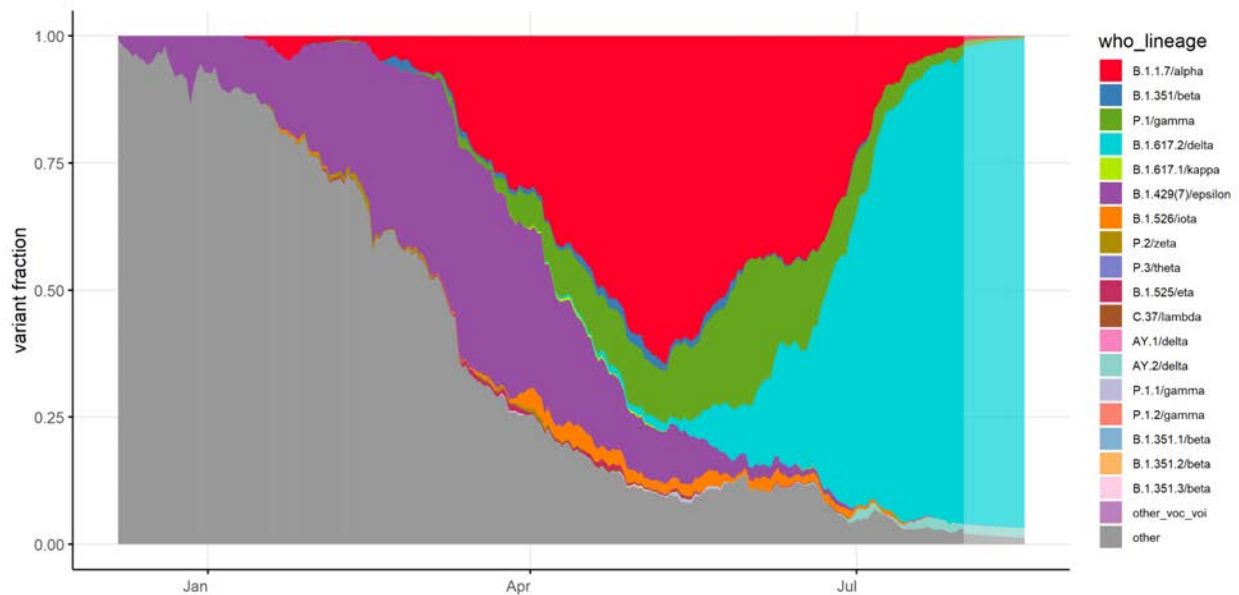


Figure 11. Estimated fraction of cases attributable to variants of concern in Washington State. Data used in this analysis exclude sequences obtained by targeting B.1.1.7/alpha. This figure shows a seven-day running average through July 31 (darker colors) and then a multinomial growth model [nowcast](#) through August 16 (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 increased exponentially over July and into early August. This has resulted in sharp increases in prevalence over this time period, with current levels exceeding peak prevalence in the winter of 2020. Hospital admissions have increased sharply through July and into August, and increases are evident in the incomplete data subsequent to August 6. Increases in beds occupied by confirmed or suspected covid patients have also increased sharply over the same time period, exceeding peak levels in the winter of 2020.

The B.1.617.2/delta variant has become the predominant [Variant of Concern \(VOC\)](#) in Washington state, with over 90% of cases attributable to this variant since mid-July. Current levels of population immunity are not sufficiently high to overcome this increased transmissibility of B.1.617.2/delta, resulting in sharp increases in cases and hospital admissions across the state, [primarily among the unvaccinated](#). Our analysis of hospital admission rates by vaccination status indicates that as of July 31, hospital admission rates among the unvaccinated population 16-44 and 45-64 are 10 times as high as those in the fully vaccinated population in those age groups, and in the 65+ population, hospital admission rates are 6 times as high in unvaccinated persons as in vaccinated persons. Hospital admission rates in the unvaccinated far exceed peak hospital admission rates last December, and hospitalizations are increasing in younger people. These data highlight the very strong protection against severe disease afforded by vaccination, which in turn reduces burden on health systems--if the entire population were to experience the rates of hospitalizations currently seen in the unvaccinated, the hospital system would be completely overwhelmed.

High current R_e estimates due to predominance of the delta variant are very concerning, reflecting sharp increases in prevalence and hospital admissions through early August. Hospitals across the state are functioning at very high occupancy due to sharp increases in COVID-19 cases, increased acuity of admissions, and staffing shortages. Increased population vaccine uptake is critical to reducing transmission in the mid and long-term. To reduce transmission and burdens on the health care system in the short term it is critical to resume use of NPIs, particularly masking in public indoor settings and crowded outdoor settings, regardless of vaccination status.

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 August 16, and to hedge against delays in reporting, we analyze data as recent as August 6 across the state for cases and hospital admissions, and as recent as July 30 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% (95% CI: 52% to 64%) 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, and Dr. Mike Famulare, 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.