

COVID-19 transmission across Washington State

Washington State Department of Health
October 20, 2021



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Publication Number 820-114

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SitRep 40: COVID-19 transmission across Washington State

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Results as of October 19, 2021.

The current Situation Report is based on complete data through October 8. 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 October 8 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 October 8 indicate that COVID-19 transmission in Washington state is decreasing, with R-effective slightly below 1 from late August through October 2. Prevalence of COVID-19 has been declining since early September, but levels are still high.

Cases: Since the last report, case counts have steadily declined, though they still remain high, at levels similar to those observed in November of 2020.

Hospital admissions: Hospital admissions and occupancy also began to decline over the past month. Both admissions and occupancy still remain at high levels similar to the peak levels experienced in the surge of November 2020-January 2021.

Variants: The delta variant continues to account for almost 100% of cases sequenced.

Outlook: Hospitals across the state are operating at full capacity, and projections while less dire than last month continue to suggest that high levels of occupancy are likely to persist through the fall.

Public health action: Vaccination continues to be the most effective strategy to reduce COVID-19 transmission and reduce the risk of severe disease. Wear a mask in public indoor settings and crowded outdoor settings, regardless of vaccination status, and avoid crowded situations. Vaccinate against influenza to prepare for flu season. In tandem, these actions will help prevent further burden on the healthcare system.

Statewide estimates of the effective reproductive number

Using data from the [Washington Disease Reporting System](#) (WDRS) through October 8, we are reporting the effective reproductive number (R_e) as of October 2. The green line and green-shaded region shows estimates of total R_e which accounts for contributions from behavior, variants, and population immunity, either from prior infection or due to vaccination. On October 2, R_e was likely between 0.67 and 0.98, with a best estimate of 0.83. R_e increased sharply in early July, reflecting rapidly increasing transmission across the state due to the delta variant. The drop in R_e starting the end of July could reflect increases in preventive behaviors, such as masking, as people became more aware of the delta surge. R_e has remained slightly below 1 since late August. 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 exposure and transmission including wearing masks in public indoor settings and crowded outdoor settings, or avoiding crowded settings altogether, regardless of vaccination status.

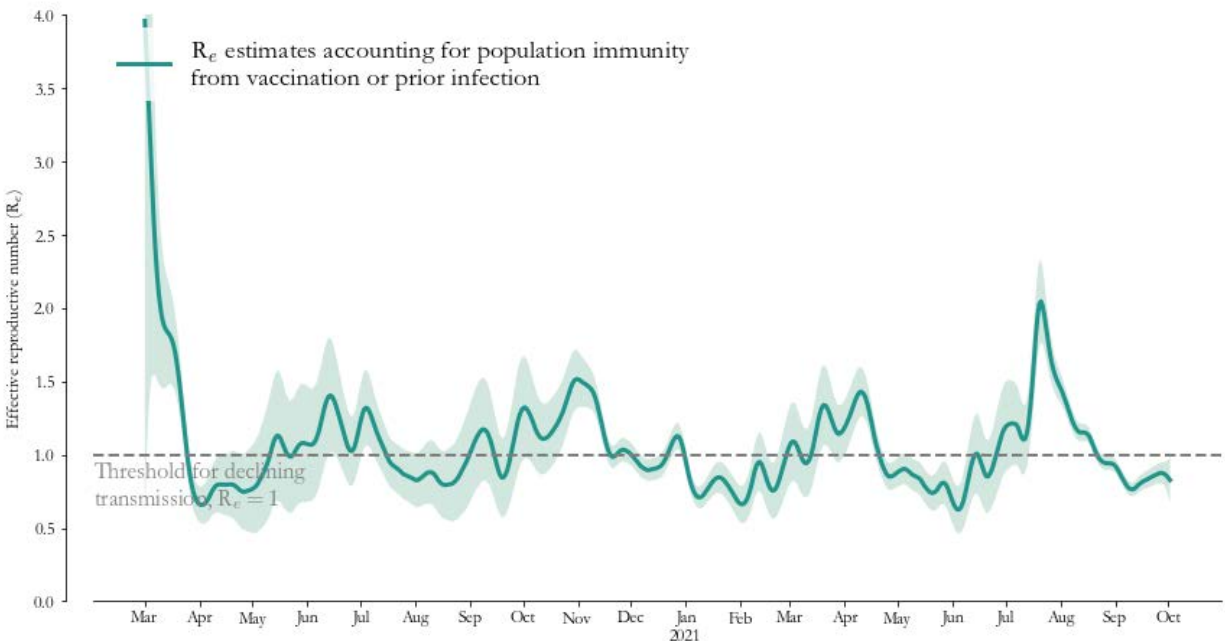


Figure 1: R_e estimates for Washington state. The green line and green-shaded region depict the “total” R_e , which accounts for behavior, variants, and population immunity.

Model-based statewide prevalence

On October 8, overall prevalence (the percentage of Washington state residents with active COVID-19 infection) in Washington state was likely between 0.25% and 0.54%, with a best estimate of 0.41% (Figure 2). This translates to 1 in 244 WA residents currently estimated to have an active COVID-19 infection (symptomatic and asymptomatic). Prevalence increased sharply through July, exceeding levels during the third wave of infection that lasted from November 2020-January 2021. Since early September, prevalence has steadily declined, and as of October 8 has decreased by about 50% since our last report in September. Despite these declines, prevalence still remains high, similar to levels observed at the peak of the spring 2021 surge.

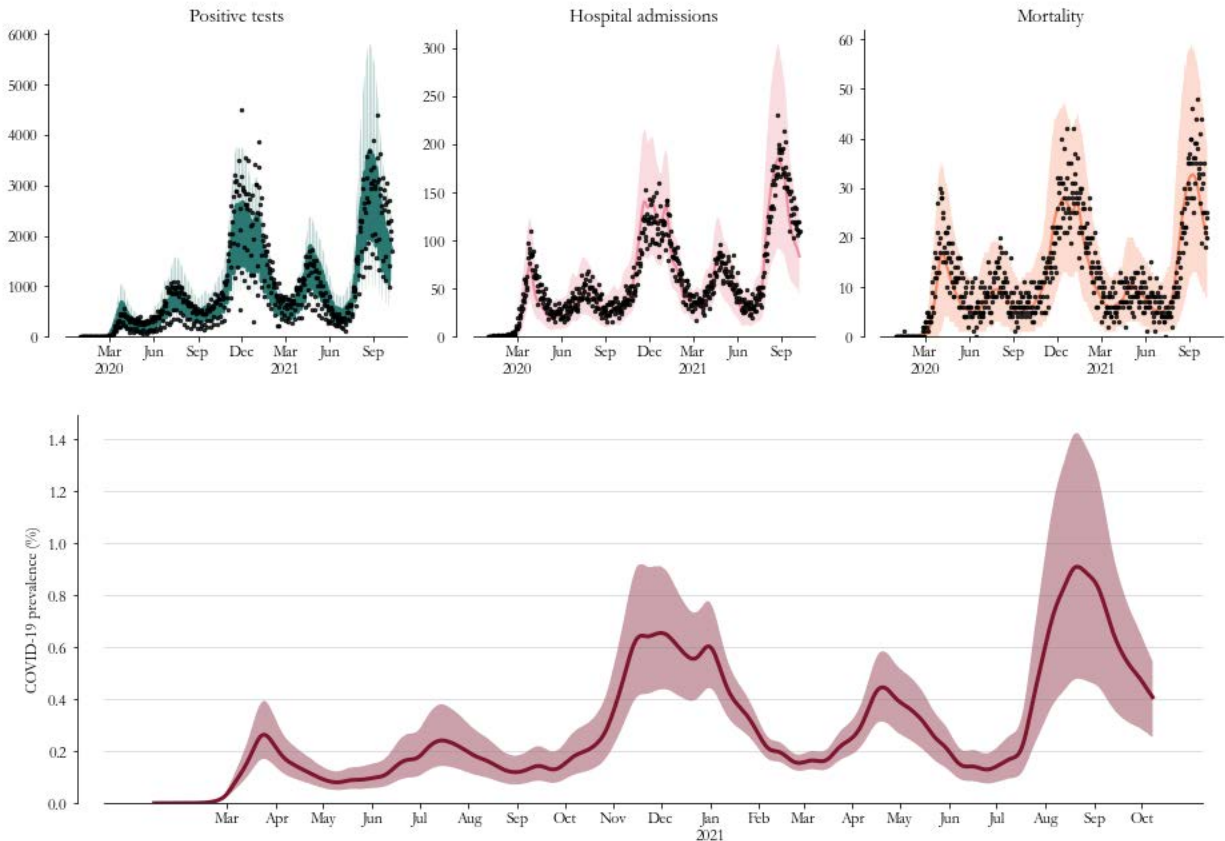


Figure 2: Model-based prevalence estimates (bottom, 95% CI shaded) and model fit to cases (top left), hospitalizations (top middle) and deaths (top right) for Washington state. Prevalence is the percentage of Washington state residents with active COVID-19 infection.

Model-based statewide immunity

On October 8, we estimate that overall population immunity to SARS-CoV-2 in Washington state was between 61.5% and 65.7% with a best estimate of 63.5% (Figure 3). Immunity derived from prior infection was around 20.3% (95% uncertainty interval: 18.8% to 21.9%), and additional immunity derived from vaccination was around 43.2% (95% uncertainty interval: 41.7% to 44.6%). Overall immunity has increased more rapidly since August, reflecting both increases in immunity from prior infection due to the delta surge, as well as increases in vaccination.

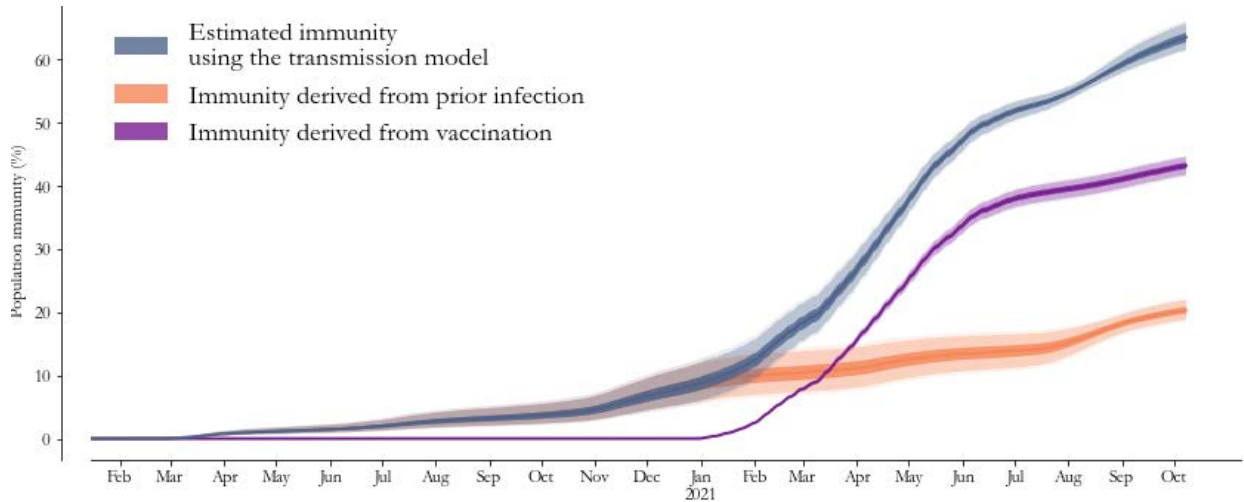


Figure 3: Model-based estimates of population-level immunity to SARS-CoV-2 infection as of October 8. Overall population immunity is indicated in the blue line and shaded area. The percent of the population deriving immunity from prior infection, is shown in orange. Individuals who acquire immunity from both infection and vaccination are counted in the immunity from prior infection estimate. The additional percent of the population deriving immunity only from vaccination at least 14 days prior is shown in purple. 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 declined since early September. The seven-day rolling average case count declined from a peak of 2937 on January 8 to 745 cases per day as of February 15, remained at that level for a month, increased to 1518 cases per day as of April 23 and declined to 376 as of July 3 and increased to the most recent peak of 3552 as of September 13 and declined to 2224 as of October 8. (Figure 4)

Hospital admissions also began to decline in early September. 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 84 as of April 27, declined to a low of 30 as of June 16, and flattened at around 30 through July 8. Admissions increased to 195 as of Aug 29, and have since declined substantially to 115 as of October 8, but remain high.

Deaths have shown some variability at high levels since early September. The seven-day rolling average of deaths declined from a peak of 32 on January 10 to 5 as of March 23, and varied at between 5 and 10 deaths per day through early August, after which a sharp increase began, reaching 36 as of September 7. There was a slight decline in mid-September, to 32 as of September 14, and then an increase again to 38 as of September 21, and a decline to 33 as of September 28 (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).

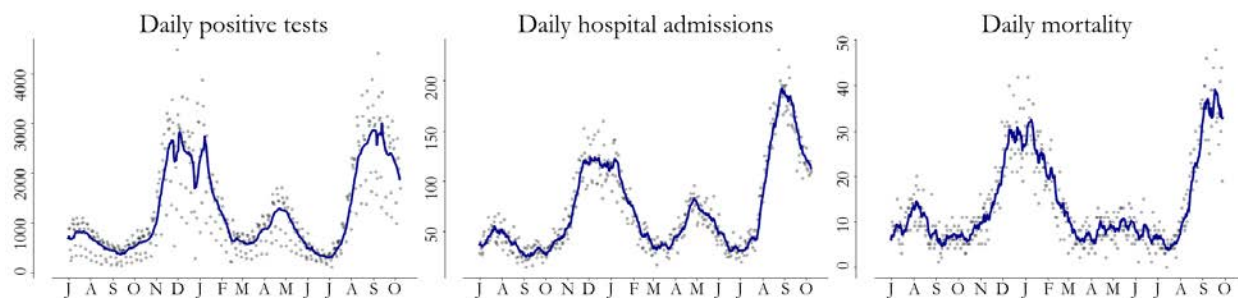


Figure 4: Seven-day rolling case counts (left panel), hospital admissions (middle panel) and deaths (right panel) for Washington from July 2020 through October 8 (cases and hospitalizations) and September 28 (deaths) 2021. Because of how confirmed deaths are being reported, we are using an earlier cutoff for data on daily mortality.

County-level trends

Case counts (Figure 5a): County-level case counts as of October 8:

- Case counts are declining in all of the five largest counties (Clark, King, Pierce, Snohomish, Spokane), though counts are still high, similar to November 2020 levels.
- All middle-sized counties are seeing declining case counts (Benton, Cowlitz, Franklin, Kitsap, Skagit, Thurston, Whatcom, Yakima), except for Grant county where cases are flattening.
- Counts are declining or flattening in many small counties (Douglas, Grays Harbor, Island, Kittitas, Lewis, Okanogan, Stevens, Walla Walla, Whitman, Clallam, Adams, Asotin, and Lincoln). Case counts are increasing in Chelan and Klickitat. All other small counties have fewer than 10 cases per day.

Case rates (Figure 5b): Figure 5b shows the decrease in county-specific case rates across the state for the two-week period ending on October 8 compared to the two-week period ending on September 8. For the period ending on September 8, 32 counties had rates above 500 per 100,000. In comparison, for the two-week period ending October 8, 17 counties had rates above 500 per 100,000.

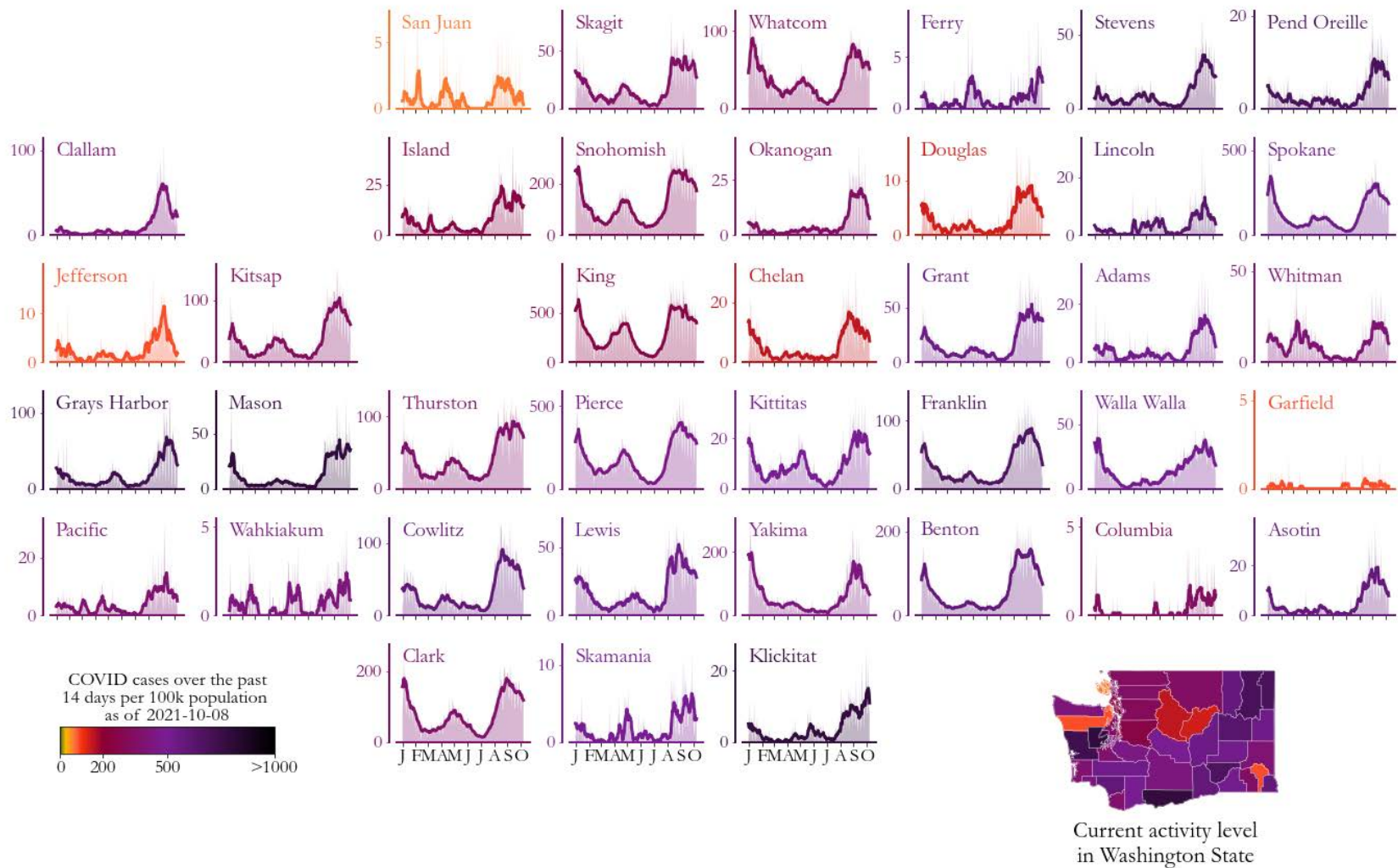
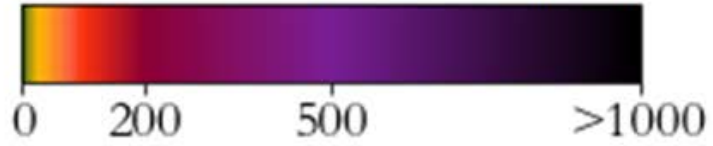
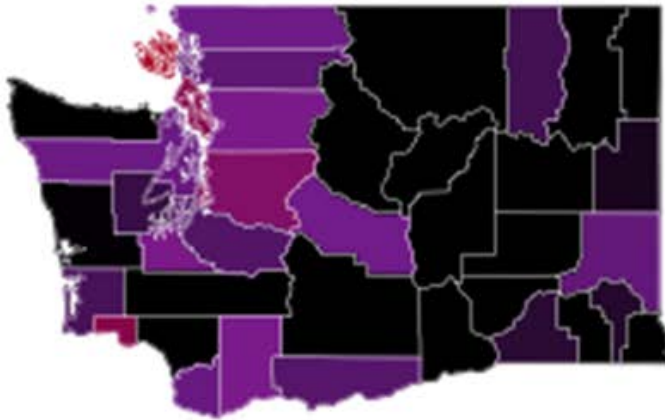


Figure 5a: Daily COVID-19 positives (shaded areas) and 7-day moving averages (curves) arranged geographically and colored by COVID-19 activity level (total cases from September 25 to October 8 per 100,000 people). Case trends across counties highlight geographic correlations and help us better understand region-level estimates of the transmission rate (see Figure 1).

COVID-19 cases per 100,000 people



Two weeks ending on September 8



Two weeks ending on October 8

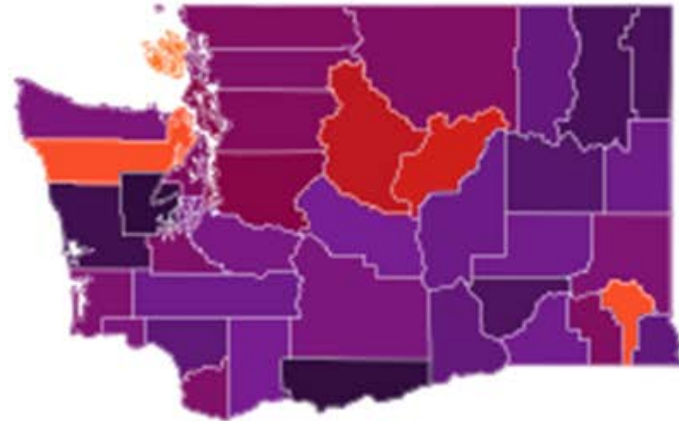


Figure 5b: 14-day COVID-19 case rates (cases per 100,000 people) by county over two time periods, the two-week period ending on September 8 (left), and the two-week period ending on October 8 (right).

Trends in case rates by age group

Across Washington state, 14-day case rates (cases per 14-day period per 100,000 people) increased sharply in all age groups from early July through mid-August, when they began to decline (Figure 6). As of October 8, case rates in all age groups continue to decline, although the decline began noticeably later among children and adolescents aged 0-9 and 10-19 (shown separately in the lower panel for clarity) than it did for most adult age groups. This may be related to increased testing of children and adolescents as schools reopened this fall, as this pattern is not observed in hospital admissions in the 0-19 age group (Figure 7, next page). While case rates among adults at the peak of the delta surge were similar to those at the peak of the winter 2020 surge, case rates among children were about 1.5 times higher at the peak of the delta surge than at the peak of the winter 2020 surge.

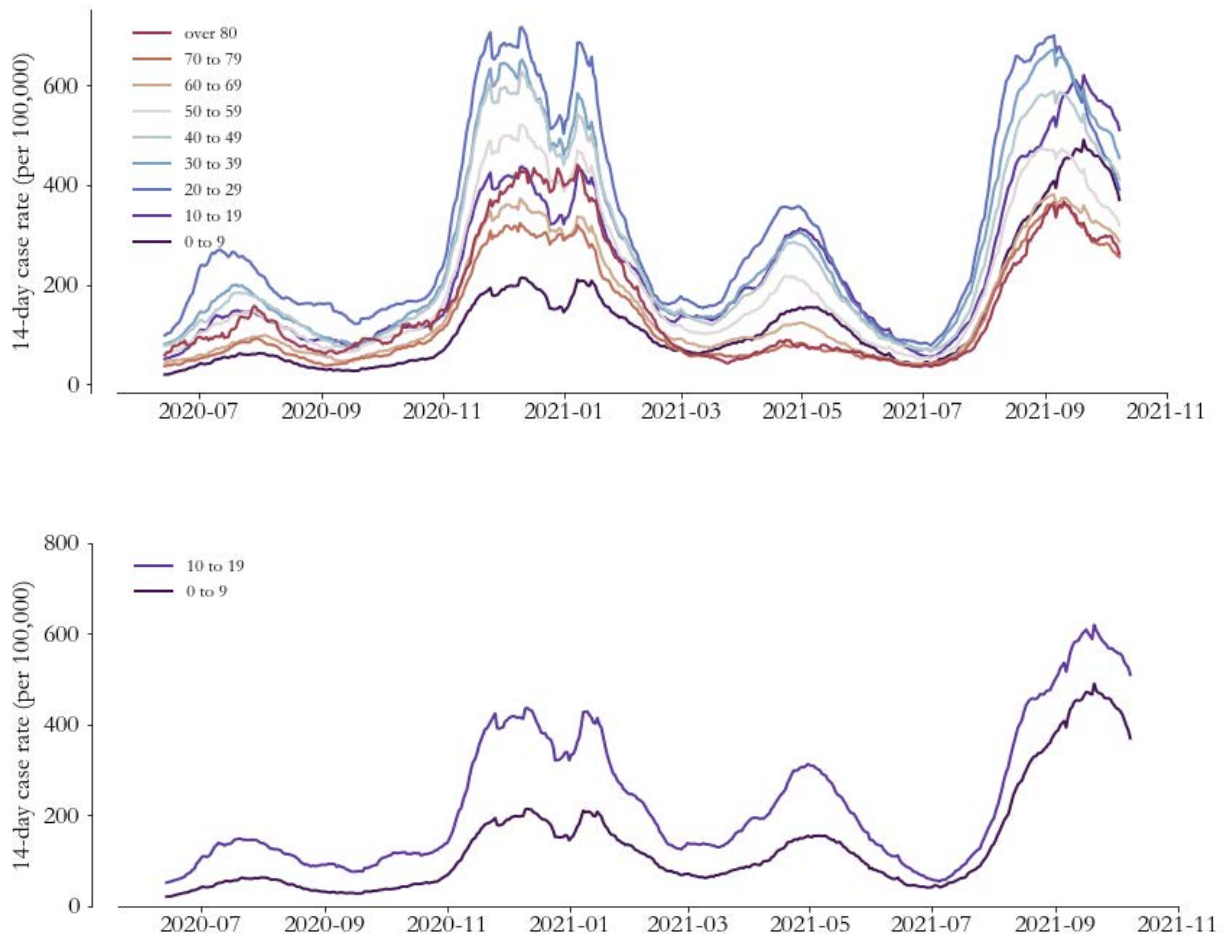


Figure 6. 14-day case rates by 10-year age group across Washington state, as of October 8, 2021. The upper panel shows rates by 10-year age group for all ages 0-80+. The bottom panel shows the rates separately for the 0-19 population.

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 increased from July through early September, when they began to decline in most age groups. As of October 8, admission rates are declining in most adult age groups, with some flattening in the 30-39 and 50-59 age groups (Figure 7). Admission rates for ages 0-19 remain low.

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. Data as of October 16 (not shown) from hospital reports to the WA Health system show declines in hospital admissions in most adult age groups, except for ages 80+, among whom rates are plateauing.

Vaccination continues to protect many Washington residents from serious illness. Hospital admission rates remain at least 9 times higher among the unvaccinated than among the fully vaccinated across age groups (for further details see the [full DOH report](#) on cases, hospitalizations, and deaths by vaccination status).

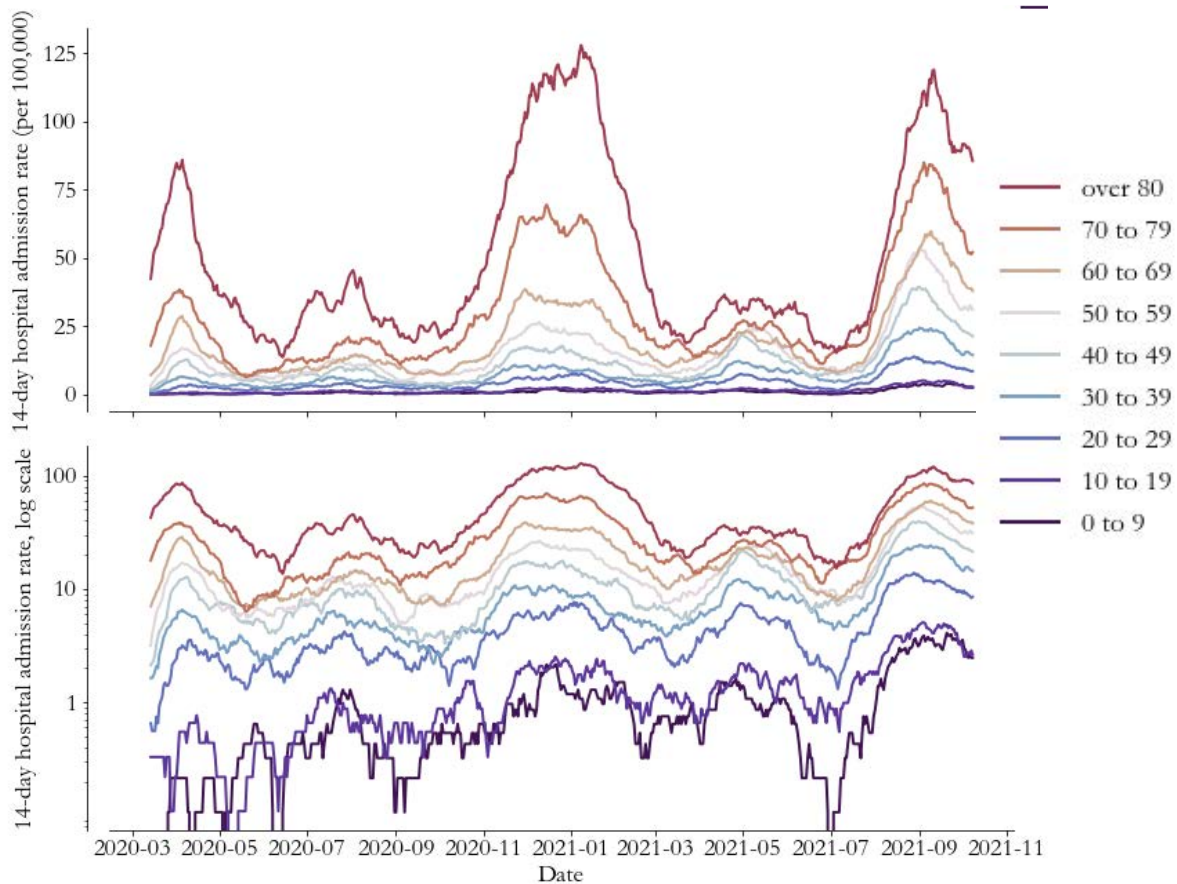


Figure 7. Statewide 14-day hospital admission rate per 100,000 population by 10-year age group as of September 8. The top panel shows the rates on a standard numeric scale, and the bottom panel shows the rates on a log scale to be able to better compare the rate of decline between age groups that have large differences in rates.

Hospital occupancy

Across the state, the number of total hospital beds (Figure 8, top panel) and ICU beds (Figure 8, bottom panel) occupied by confirmed or suspected COVID-19 patients increased sharply starting in mid-July and peaked in mid-September. Declines have continued through October 16, but current occupancy levels still remain high, similar to those observed at the peak of the third wave of infection in November 2020-January 2021. Although hospital occupancy related to COVID-19 has declined from nearly 25% of bed capacity in early September to around 17% in early October, total hospital occupancy has remained constant at over 90% (Figure 9). Hospitals remain at very high occupancy despite declines in COVID-19 related occupancy. This is due to increases in people seeking health care and elective procedures deferred at the peak of the delta surge, as well as staffing shortages.

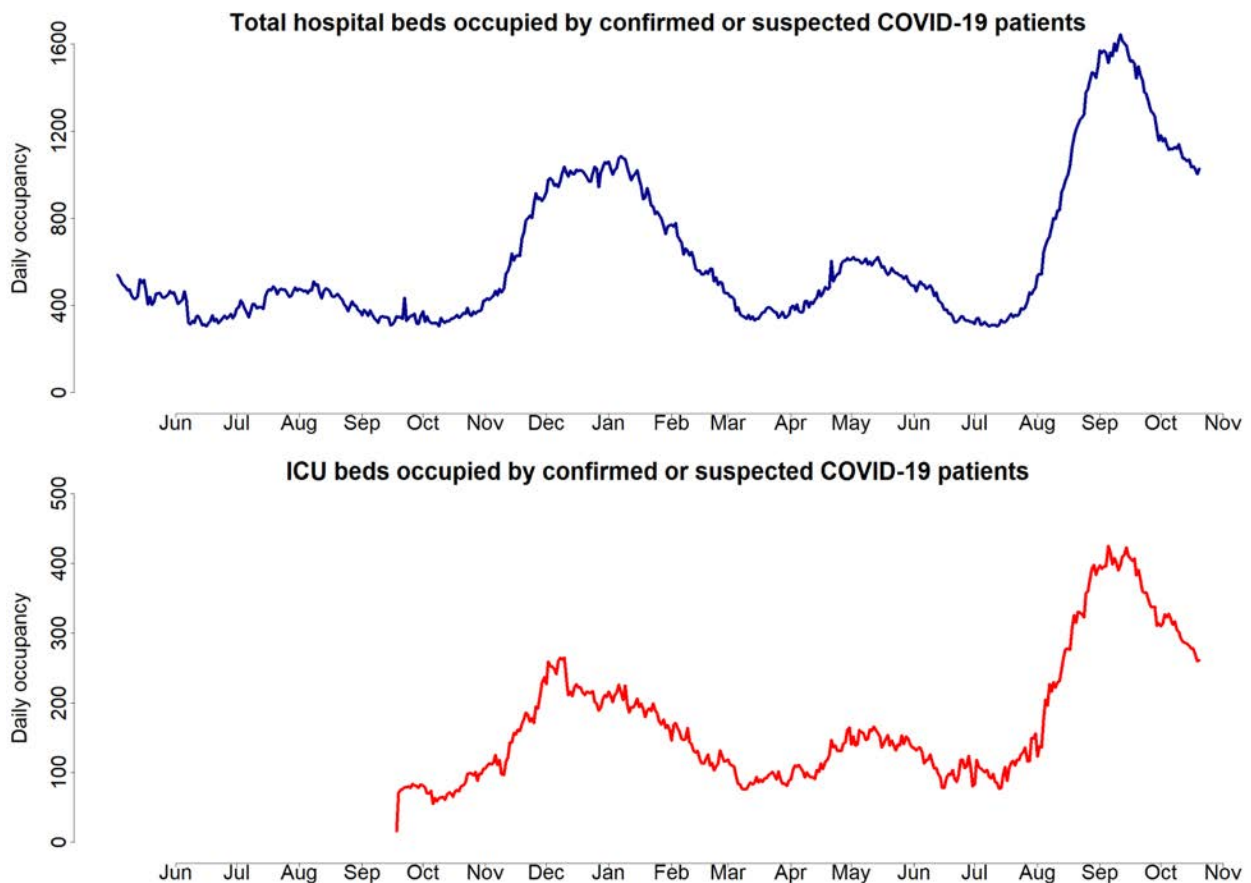


Figure 8. Total hospital beds and ICU beds occupied by confirmed or suspected COVID-19 patients reported through the WA Health system. Data collection for ICU beds occupied by COVID-19 patients started September 17, 2020. Hospital occupancy data has minimal reporting lag, and is shown here using data up to October 16, 2021. 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.

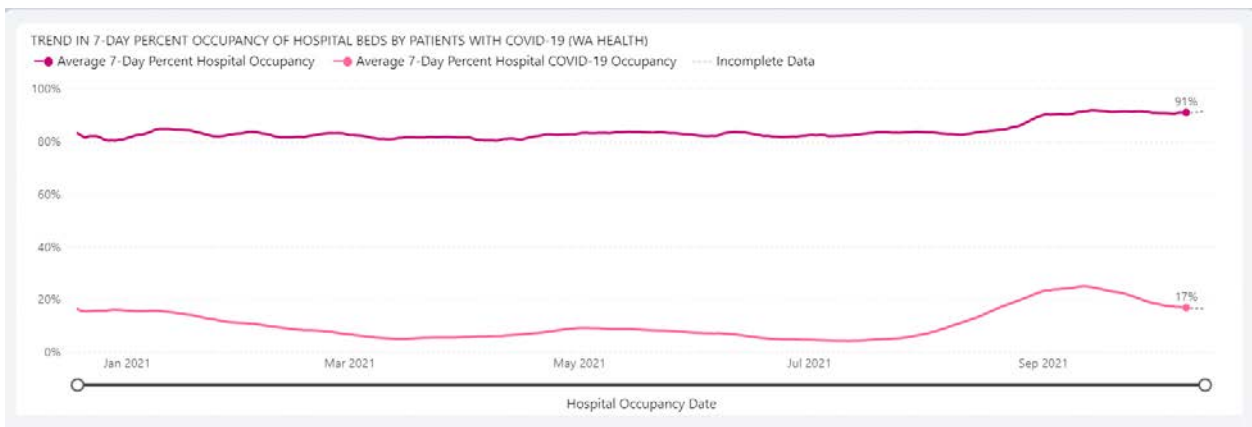


Figure 9. 7-day average of percent of acute care staffed hospital beds occupied by all patients (maroon line), and percent of acute care staffed hospital beds occupied by COVID-19 patients (pink line) based on data from the WA Health system, using data through October 14. Accessed from the Healthcare System Readiness tab of the [DOH COVID-19 dashboard](#).

Hospital admission projections

We have projected hospital admissions and occupancy through the end of December under two scenarios. The first scenario assumes transmission drops slightly over the next two weeks from the current estimate of R_e of 0.83, followed by a modest increase in transmission through the end of December. This increase is similar to the increase that occurred from March to April during the spring wave. The second scenario assumes a moderate increase in transmission through December, increasing at twice the rate of the first scenario. While vaccination provides much more protection this fall and winter compared to last year, exposure to COVID-19 and disease transmission continues to be influenced by our behavior. Potential increases in transmission could result from the combined effects of relaxations in NPI behavior, increased travel and holiday gatherings, increasing time spent indoors with people outside one's household, other seasonal related effects and school related transmission.

Under the modest increase scenario, we project that hospital admissions will continue to decrease through December, with the rate of decrease leveling off by the end of December at between 10 and 60 admissions per day (Figure 10), a level that is slightly lower than the low points seen after prior waves. Under the moderate increase scenario, the decrease in admissions levels out in mid-November, followed by increases through the end of December, reaching between 50 and 210 admissions per day at the end of December. Considerable uncertainty is inherent in both scenarios, and we have little data to estimate whether increases in transmission are more likely to be modest or moderate. Still, they provide insight into potential future burdens on the health system.

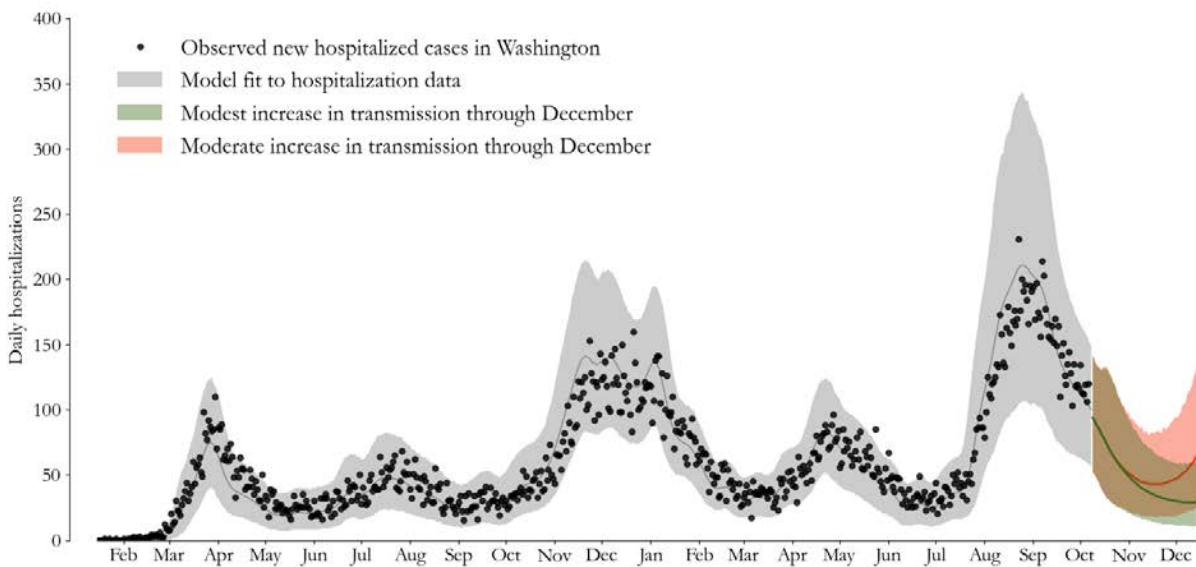
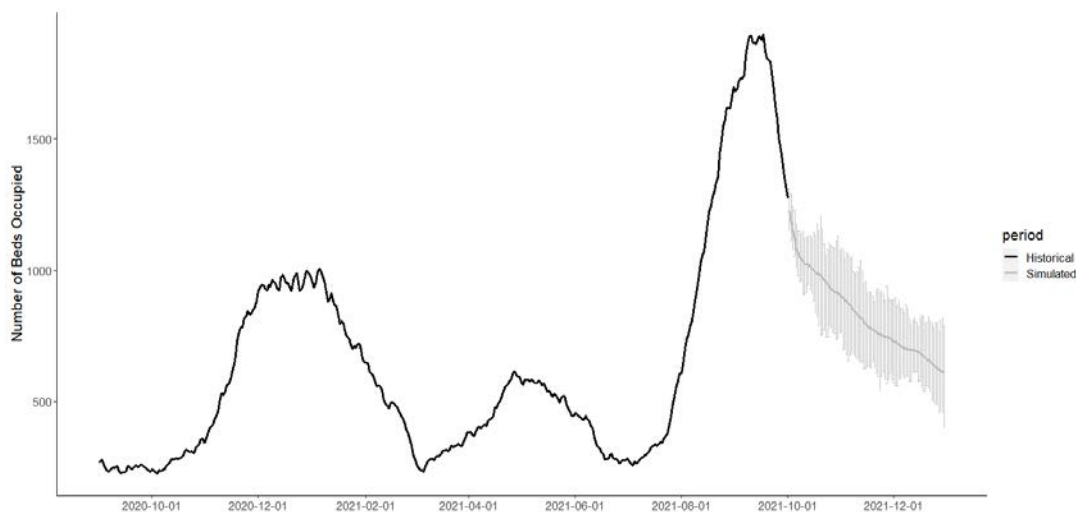


Figure 10. Projections of hospital admissions based on two transmission scenarios, a scenario with modest increases in transmission (green line and shaded area), and a scenario with a moderate increase in transmission (red line and shaded area).

Hospital occupancy projections

We used the hospital admission projections described above to project hospital beds occupied under the two scenarios. The modest increase in transmission scenario projects a slow decrease in beds occupied by COVID patients through the end of December, reaching between 400 and 790 beds occupied per day. The moderate increase in transmission scenario results in a slow decrease in occupancy through early November, followed by increases through the end of the year, reaching between 530 and 1375 beds occupied per day (Figure 11). Although the number of beds occupied by COVID patients is projected to fall in both scenarios through November, overall capacity will remain tight due to a build up of delayed care and continued staffing shortages. Seasonal increases in hospital admissions related to other respiratory viruses including influenza will likely further increase occupancy.

Modest increase scenario



Moderate increase scenario

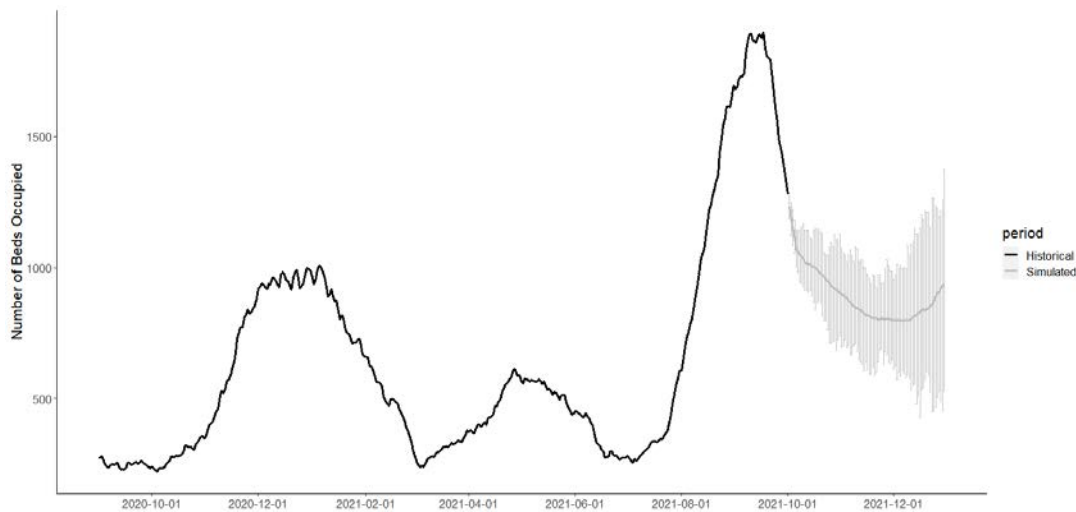


Figure 11. Projections of hospital occupancy based on two transmission scenarios, one based on a modest increase in transmission (upper panel), and the other based on a moderate increase in transmission (lower panel).

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 September 29, and using a multinomial generalized additive model, we estimate that as of October 18, nearly 100% of cases are due to the delta variant (B.1.617.2 and AY.1-33 sublineages) (Figure 12). There is some 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.

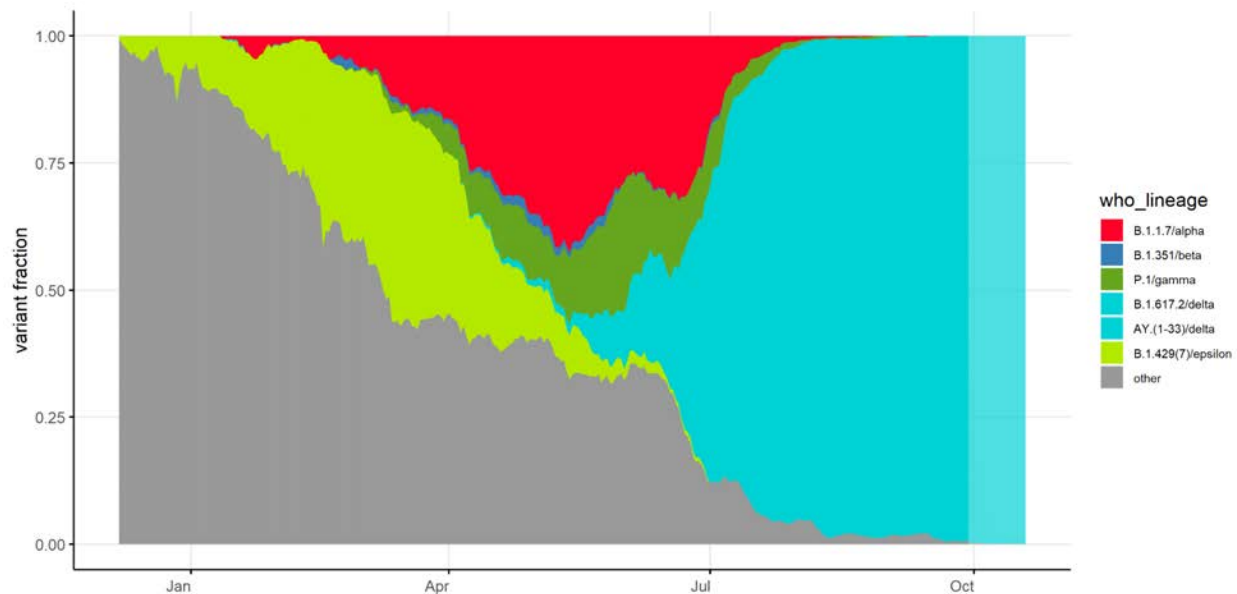


Figure 12. Estimated fraction of cases attributable to variants of concern and variants of interest in Washington State. Data used in this analysis exclude sequences obtained by targeting B.1.1.7/alpha. This figure shows a seven-day running average through September 29 (darker colors) and then a multinomial growth model [nowcast](#) through October 18 (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 increased exponentially over July corresponding to increasing predominance of the delta variant. Subsequently, R_e declined through August, likely due to increases in protective population behaviors such as masking. R_e has remained slightly below one since late August. Prevalence increased sharply through mid-August and has been declining since, though levels still remain high--similar to those observed at the peak of the spring 2021 surge. Cases and hospital admissions have declined steadily since September, though they still remain high, at levels similar to the peak of the November 2020-January 2021 surge. Deaths remain high as of the end of September. Declines in both total and ICU beds occupied by confirmed or suspected COVID-19 patients began in mid-September, but occupancy levels remain extremely high, and many hospitals across the state are operating at or near full capacity.

The B.1.617.2 and AY.(1-33) delta variant lineages have remained the predominant [Variant of Concern \(VOC\)](#) in Washington state, with close to 100% of cases attributable to this variant since mid-August. Although hospital admission rates are declining, rates remain at least 9 times higher among [the unvaccinated](#) in comparison to the fully vaccinated. Vaccines continue to afford strong protection against severe disease, reducing strain on an already stretched health care system.

The near-term outlook suggests that trends are moving in the right direction, although cases, hospital admissions, and deaths remain high. Medium term projections depend on whether increasing transmission or increasing population immunity has more impact. At current levels of transmission, the effects of increasing population immunity due to the surge in delta cases and the slowly increasing vaccination rates are projected to reduce cases and hospitalizations over the next month. Increased transmission through December due to holiday gatherings, seasonal changes increasing indoor activity and NPI fatigue may increase transmission levels sufficiently to offset the current level of population immunity. The estimated 36% of the population susceptible to infection will likely be hit hardest by any increases in transmission. Both scenario projections suggest that this may result in a long plateau of high levels of hospital admissions similar to what was seen November 2020 through January 2021. High levels of hospital occupancy are likely to persist through the fall, compounded by flu season and the substantial numbers of people who were forced to delay care at the peak of the delta surge.

Many hospitals across the state continue to function at extremely high occupancy, near capacity, due to continued high volumes of COVID-19 cases and staffing shortages. Currently 17% of hospital beds are occupied by COVID-19 patients. During the peak of the delta surge this was as high as 25% - one of every four beds available. High numbers of hospitalized COVID-19 patients impacts the number of beds available to treat patients for other conditions, including cancer treatment. It also strains health care providers in Washington State, both in increased workload and emotional burden of caring for patients who have to delay care because the beds that are needed may not be available.

Increased population vaccine uptake is critical to reducing transmission, but the impacts on health care services will not be seen immediately. However, the use of NPIs, particularly masking in public indoor settings and crowded outdoor settings, regardless of vaccination status can immediately reduce transmission and burden on health care. Avoiding crowded events such as sporting events, concerts, and fairs, as well as large parties and celebrations is also an important means of reducing transmission. Additionally, promoting vaccination against influenza is critical given the likelihood flu may be more

common this year. In tandem, these measures can help to prevent further pressure on the healthcare system across the state. Given the likelihood that high levels of occupancy will persist through the fall, any measures that can be taken to reduce transmission from now through the end of the year are warranted.

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 October 18, and to hedge against delays in reporting, we analyze data as recent as October 8 across the state for cases and hospital admissions, and as recent as September 28 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.