COVID-19 transmission across Washington State

Washington State Department of Health
July 21, 2021

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Publication Number 820-114

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SitRep 37: COVID-19 transmission across Washington State

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Results as of July 21, 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 July 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 July 8 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 July 8 indicate that COVID-19 transmission in Washington state has increased over the last week of June, with R-effective close to 1.5 as of July 2. Prevalence of COVID-19 has started to increase over this time period.
Cases: Case counts show recent signs of increases, both statewide and in many counties. Case rates are increasing in the 20-29 and 30-39 year-old age groups, and flat in other age groups.
Hospital admissions: Hospital admission rates are flat in most age groups through July 8, with increases seen in the 40-49 and 70-79 year age groups. Increases in hospitalizations are apparent in the incomplete data since July 8. Overall COVID-related hospital occupancy has increased since the start of July.
Variants: The more transmissible delta variants continue to spread across the state. Projections based on data through June 27 indicate that the fraction of cases attributable to B.1.1.7/alpha (~5%) and P.1/gamma (~1%) have steeply declined, and, the B.1.617.2/delta variant shows rapid growth, and may currently account for over 90% of cases.
Public health message: Cases and hospitalizations are increasing in Washington state as the delta variant grows in predominance. 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 July 8, we are reporting the reproductive number (R_e) as of July 2. 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 2, $R_e$was likely between 0.93 and 1.98, with a best estimate of 1.46. The last week of June and first 2 days of July have seen a sharp increase in Re, possibly related to increased transmission due to the June 26 to June 29 heatwave and the increasing predominance of the more transmissible delta variant. The wide uncertainty intervals around the current estimate make it difficult to establish how far above one it has risen, however if Re remains at the current estimated value for any sustained amount of time it will result in a period of increasing cases and hospitalizations. 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).

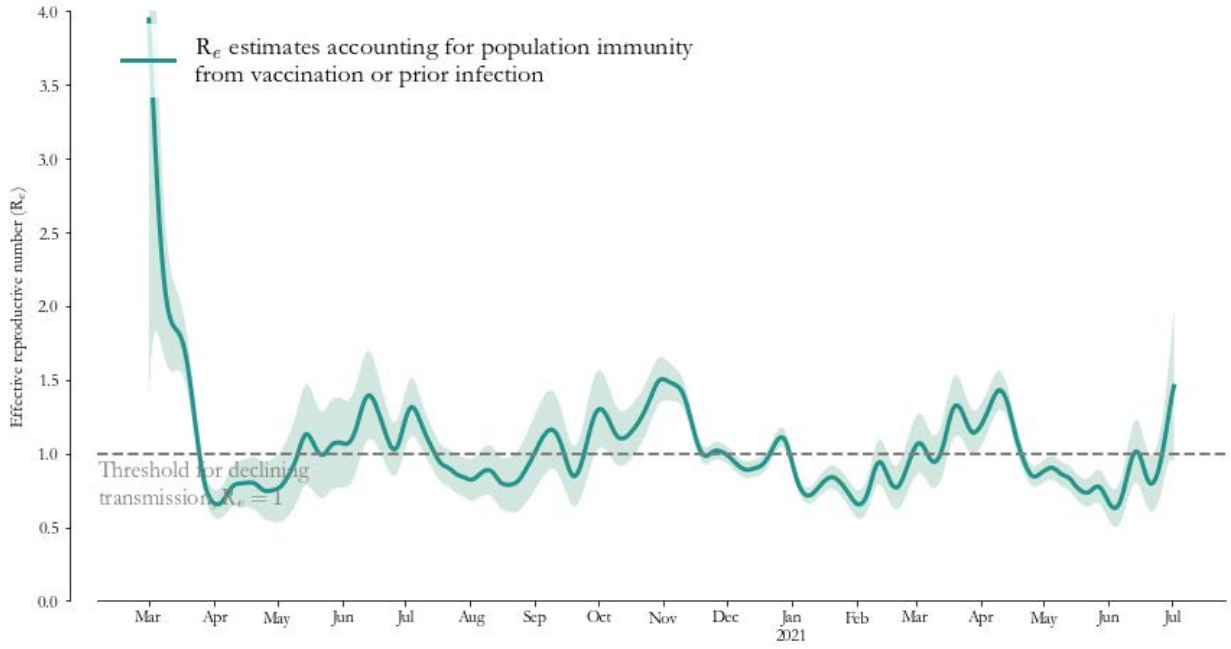

***Figure 1**: R_e estimates for Washington state. The green line and green-shaded region depict the "total" R_e, which accounts for behavior, variants, and population immunity.*

Model-based statewide prevalence

On July 8, overall prevalence (the percentage of Washington state residents with active COVID-19 infection) in Washington state was likely between 0.11% and 0.24%, with a best estimate of 0.17% (Figure 2). The decline in prevalence that began in late April flattened out in mid-June, and has increased over the first week of July.

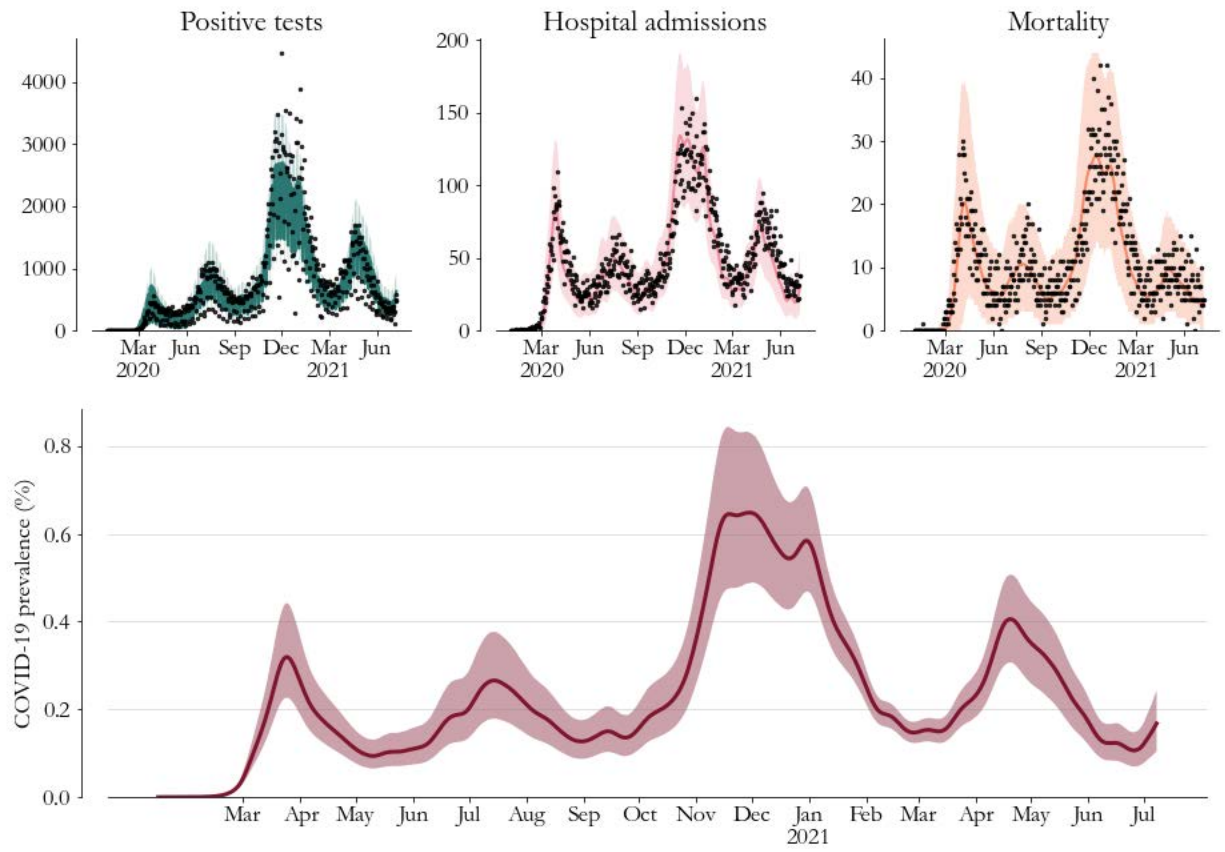

***Figure 2**: Model-based prevalence estimates (bottom, 95% CI shaded) and model fit to cases (top left), hospitalizations (top middle) and deaths (top right) for Washington state. Prevalence is the percentage of Washington state residents with active COVID-19 infection.*

Model-based statewide immunity

On July 8, we estimate that overall population immunity to SARS-CoV-2 in Washington state was between 50.8% and 52.9%, with a best estimate of 51.9%. (Figure 3). Immunity derived from vaccination was around 37.8% (95% uncertainty interval: 36.8% to 38.8%), and immunity derived from prior infection was around 14.0% (95% uncertainty interval: 12.1% to 16.0%). The increase in vaccine-derived immunity and parallel increase in total immunity that began in February has slowed considerably starting in June.

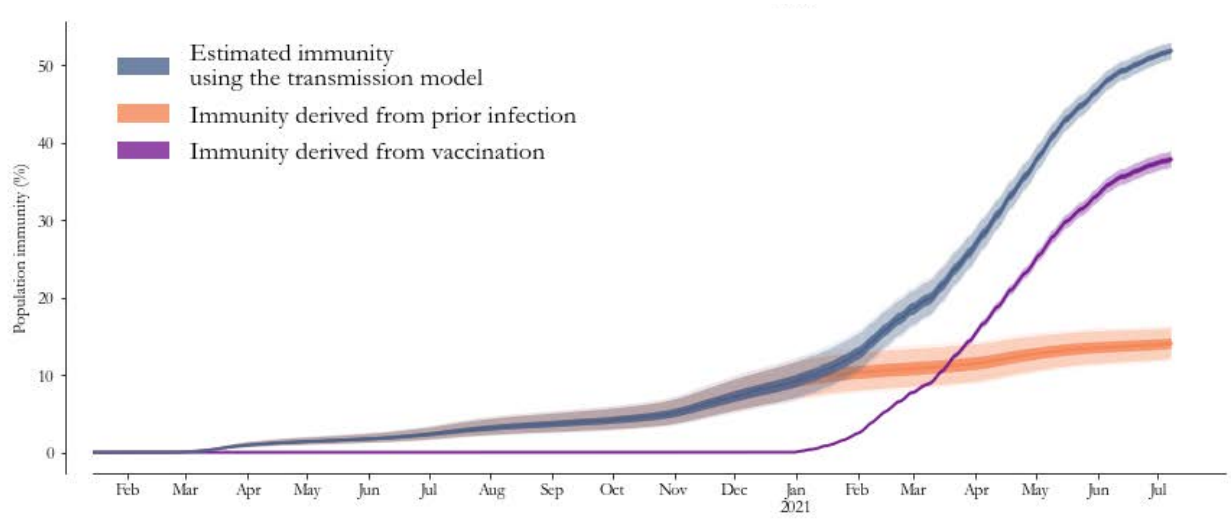

Figure 3*: Model-based estimates of population-level immunity to SARS-CoV-2 infection as of July 8. Overall population immunity is indicated in the blue line and shaded area. The percent of the population deriving immunity from vaccination at least 14 days prior is shown in purple, and the percent deriving 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 flattened starting in mid-June and have started to increase over the first week of July. 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, declined to 359 as of July 5 and have increased to 436 as of July 8. Cases continue to increase in the incomplete data subsequent to July 8. Although overall testing volume has also increased over the first week of July, the test positive percent has also increased, indicating that the increase in both testing and cases is being driven by increasing infections.

Hospital admissions have flattened starting mid-June and remained flat through the first week of July. , 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, declined to a low of 29 as of June 16, and have flattened at around 30 as of July 8. Increases in hospitalizations are apparent in the incomplete data subsequent to July 8.

Deaths have remained fairly flat, with some variability, since late March, though there may be a slightly decreasing trend over June. 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 June 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).

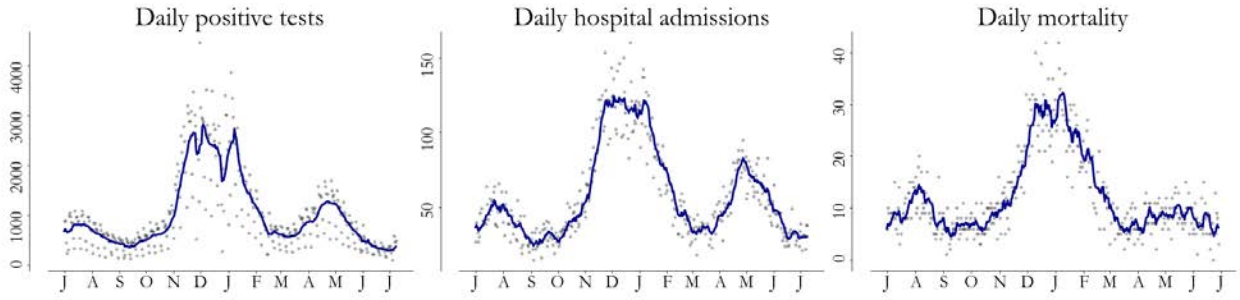

Figure 4*: Seven-day rolling case counts (left panel), hospital admissions (middle panel) and deaths (right panel) for Washington from July 2020 through July 8 (cases and hospitalizations) and June 28 (deaths) 2021. Because of how confirmed deaths are being reported, we are using an earlier cutoff for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

County-level trends

Case rates: Across Washington state as of July 8:

- 2 counties had no new cases over the prior two weeks (Columbia, San Juan). These counties do have a very small number of cases in the incomplete data.
- 1 county had 14-day rates of new cases between 100 and 200 per 100,000 people (Franklin).
- 2 counties (Benton, Walla Walla) had rates above 200 per 100,000.

Case counts: County-level case counts show multiple counties with increasing counts as of July 8:

- Among the five largest counties King, Pierce and Snohomish show increasing counts as of July 8. Clark and Spokane counties are flat through July 8 but show increases in the incomplete data.
- Almost all middle-sized counties (Benton, Franklin, Kitsap, Skagit, Thurston, Whatcom and

Yakima) are seeing increasing case counts to July 8 or have flat case counts to July 8 followed by increasing cases in the incomplete data. The exceptions are Cowlitz and Grant counties which are flat in both complete and incomplete data.

- Among small counties, Clallam, Douglas ,Island and Walla Walla are seeing increasing counts. Asotin, Chelan, Jefferson, and Whitman counties are also seeing increasing case counts, however absolute numbers in these counties are still very low. Adams, Columbia, Ferry, Garfield, Greys Harbor, Kittitas, Klickitat, Lewis, Lincoln, Mason, Okanogan, Pacific, Pend Oreille, San Juan, Stevens, Skamania and Wahkiakum counties all have flat case counts with low absolute numbers.

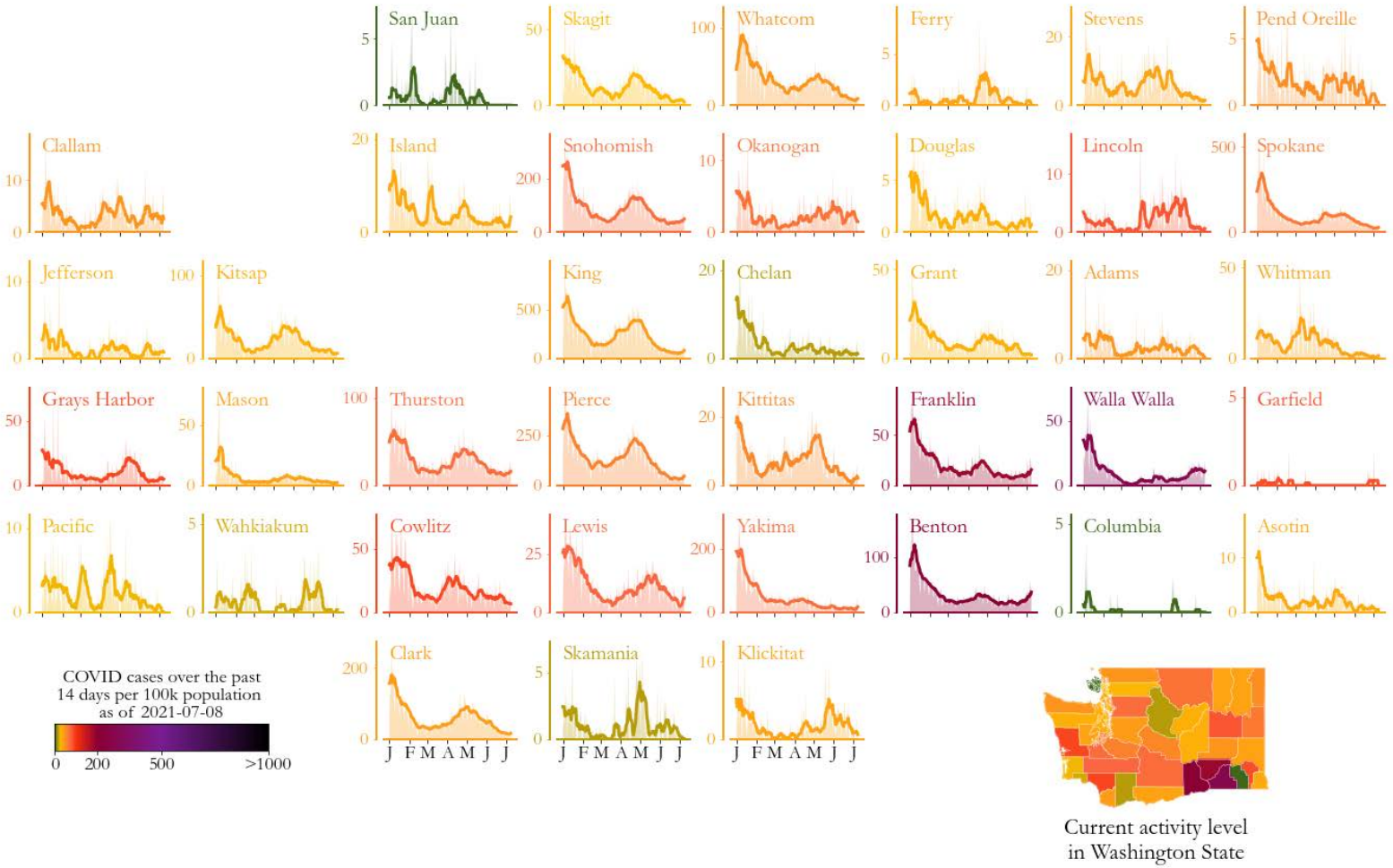

***Figure 5**: Daily COVID-19 positives (shaded areas) and 7-day moving averages (curves) arranged geographically and colored by COVID-19 activity level (total cases from June 24 to July 8 per 100,000 people). Case trends across counties highlight geographic correlations and help us better understand region-level estimates of the transmission rate (see Figure 1).*

Trends in case rates by age group

Across Washington state, 14-day case rates (cases per 14-day period per 100,000 people) that were declining over the first three weeks of June have flattened (figure 6), with increases being seen in the 20-29 and 30-39 year-old age group.

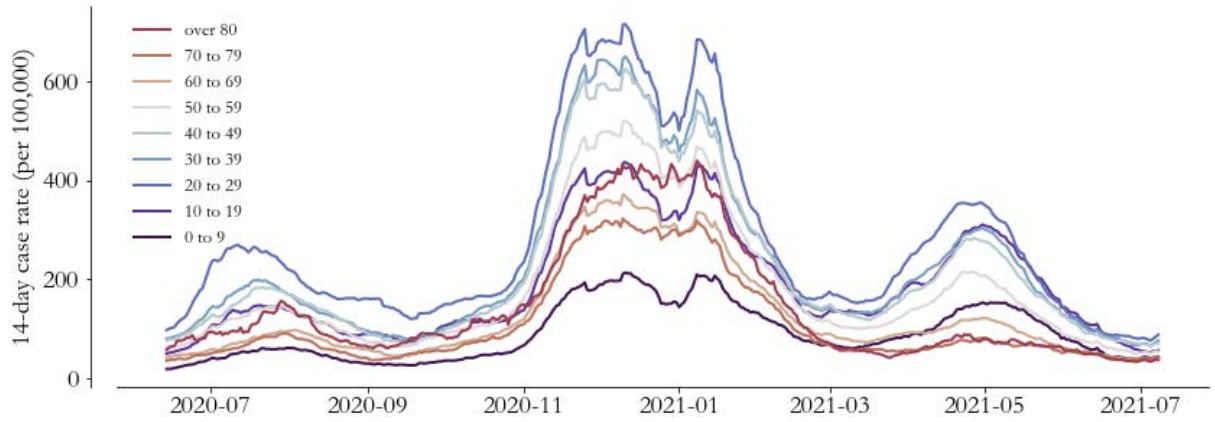

Figure 6. *14-day case rates by 10-year age group across Washington state, as of July 8, 2021.*

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 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.

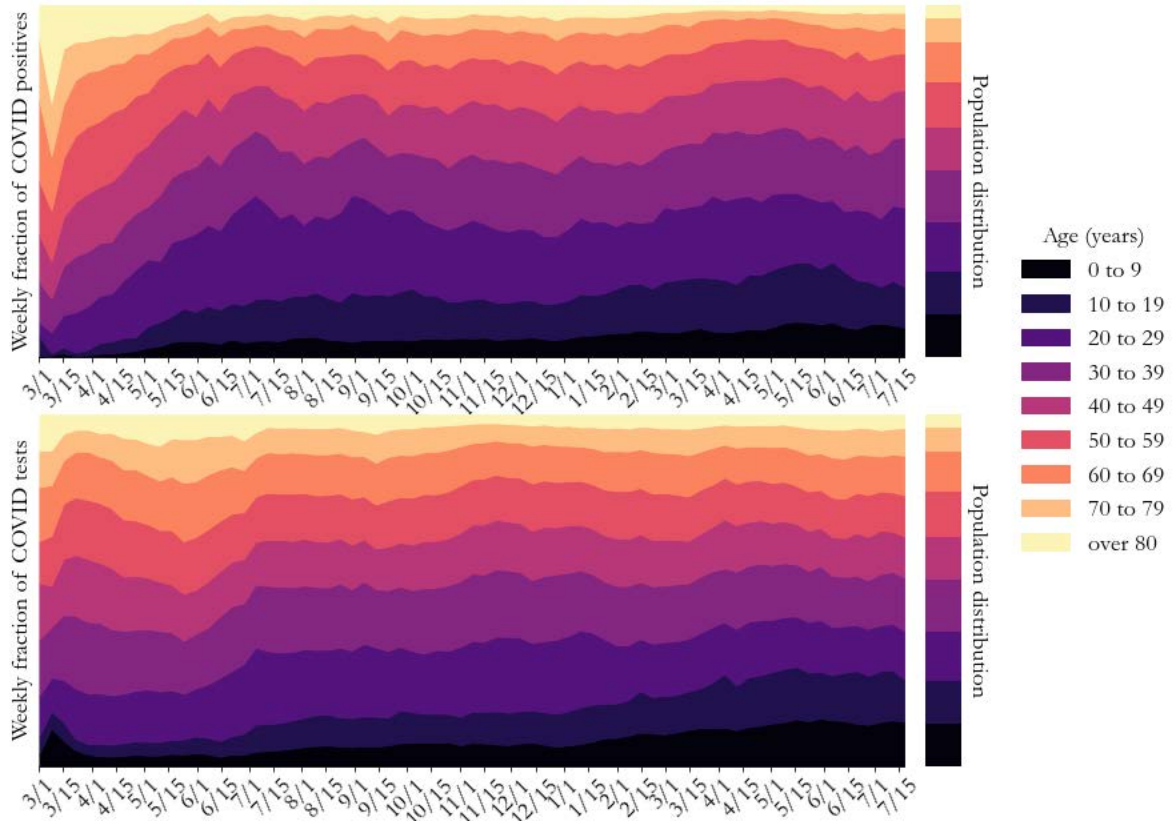

Figure 7. *The top panel of this graph shows the weekly age distribution of COVID-19 cases and the bottom panel shows the weekly age distribution of COVID-19 tests. The colors represent 10-year age groups. Early in the pandemic, populations over age 60 represented a greater fraction of total COVID-19 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 to flatten across all age groups over the last week of June. As of July 8, increases in hospital admission rates are evident in 40-49 and 70-79 year age groups. Small increases may be starting in the 20-29, 30-39 and 60-69 year age groups (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, show increasing hospital admissions in all adult age groups over the week ending July 18.

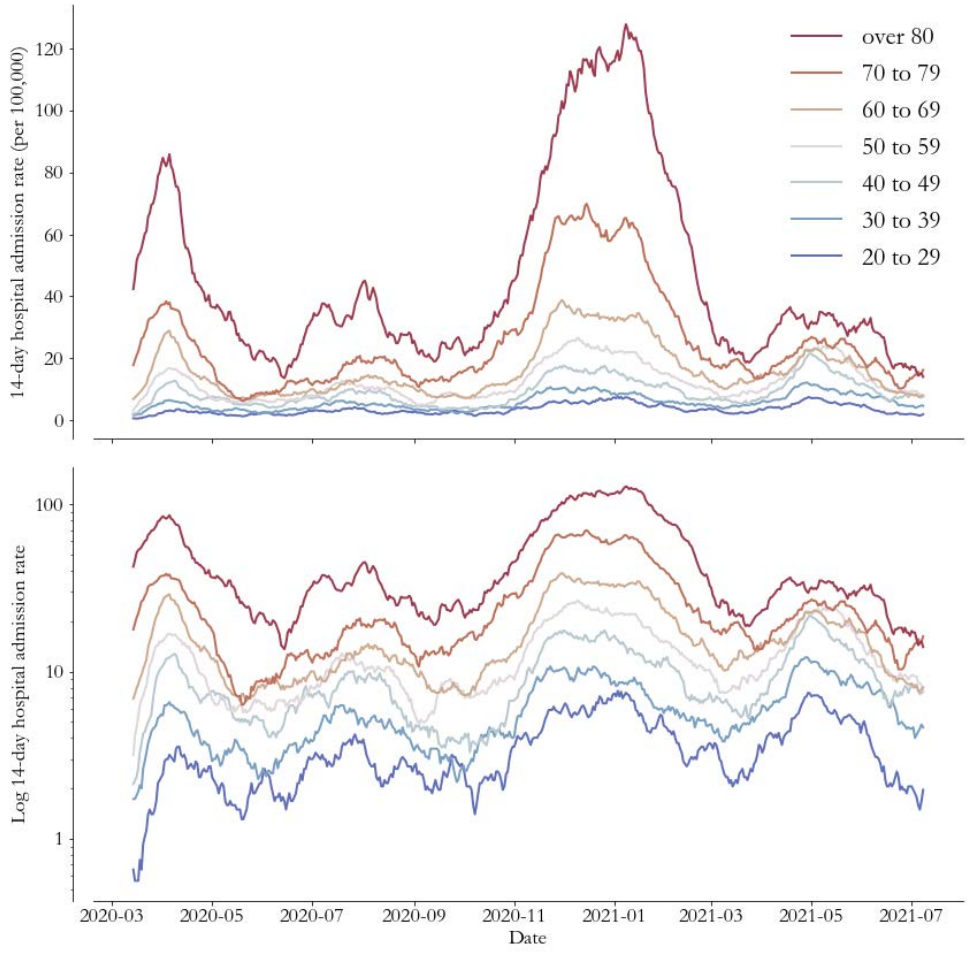

Figure 8. *Statewide 14-day hospital admission rate per 100,000 population by 10-year age group as of July 8. The top panel shows the rates on a standard numeric scale, and the bottom panel shows the rates on a log scale to be able to better compare the rate of decline between age groups that have large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

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 July 4, the 14-day hospital admission rate in unvaccinated individuals aged 45-64 is about 20 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 65 and older is approximately 9 times that in fully protected individuals in this age group. Hospital admission rates overall, and among the unvaccinated, have flattened since steep declines that occurred from mid-May through mid-June in both the 45 to 64 and 65+ age groups. The declines in hospitalization rates in unvaccinated individuals occurred during a period where increasing vaccination rates resulted in overall declines in transmission.

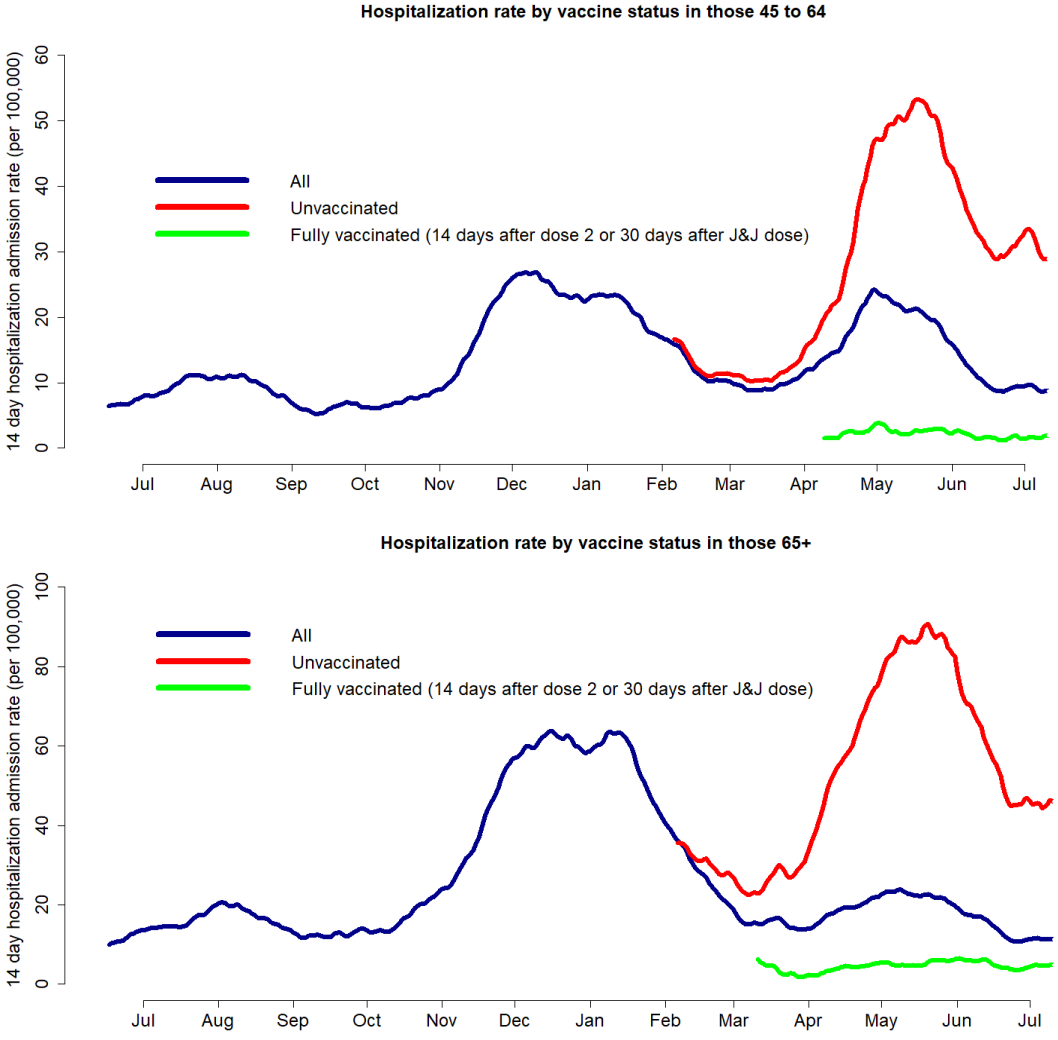

Figure 9. *Comparison of 14-day hospital admission rates between unvaccinated and fully-vaccinated adults age 45-64 (top panel) and 65 and older (bottom panel). Colors represent vaccination status, red = unvaccinated, green = those who are fully protected (14 days after 2nd dose or 30 days after J&J 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 decreased from mid-May through mid-June,flattened through early July, and has been increasing since (Figure 10). Similarly, ICU beds occupied by confirmed or suspected COVID-19 patients decreased from mid-May through mid-June. Since mid-June the numbers have remained fairly flat but with a high level of variability.

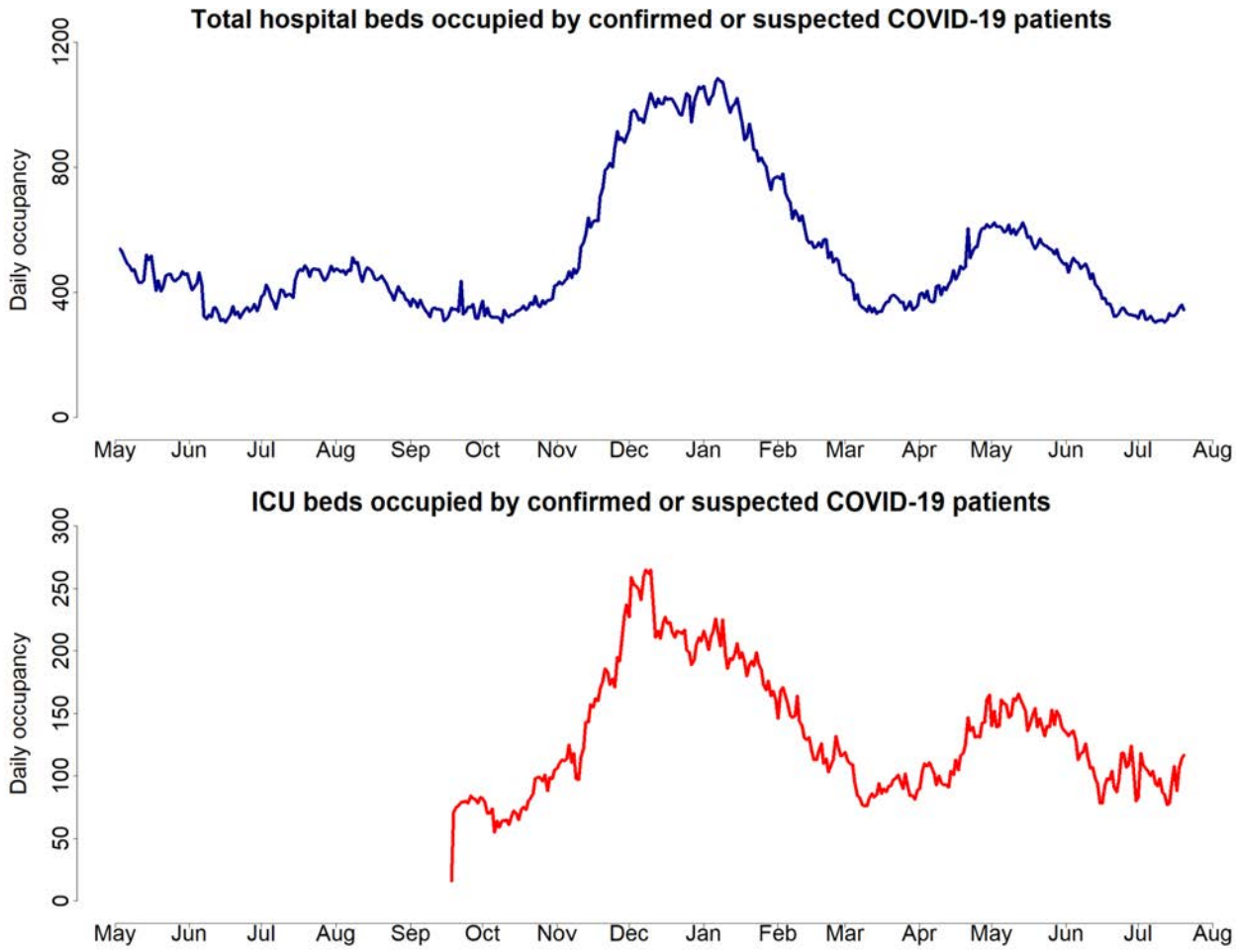

Figure 10. *Total hospital beds and ICU beds occupied by confirmed or suspected COVID-19 patients reported through the WA Health system. Data collection for ICU beds occupied by COVID-19 patients started September 17. Hospital occupancy data has minimal reporting lag, and is shown here using data up to July 18. 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 27, and using a multinomial generalized additive model, we estimate that as of July 19, around 5% of cases are attributable to B.1.1.7/alpha, less than 1% are due to P.1/gamma, and about 92% 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 is increasing exponentially. 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 and across the United States. 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.

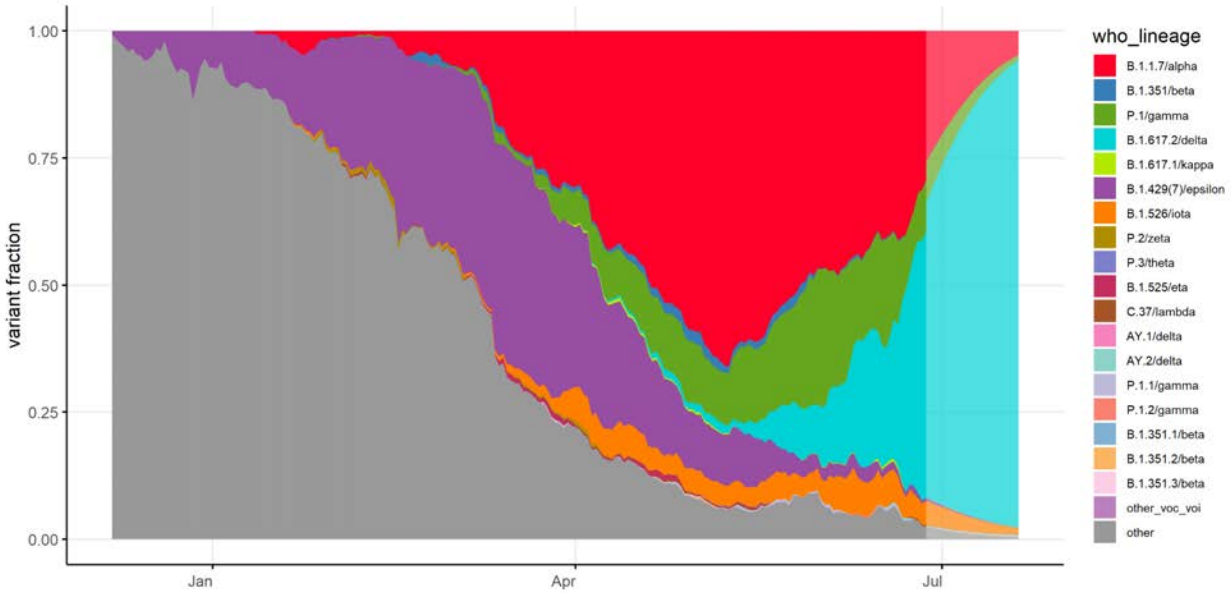

Figure 11. *Estimated fraction of cases attributable to variants of concern in Washington State. Data used in this analysis exclude sequences obtained by targeting B.1.1.7/alpha. This figure shows a seven-day running average through June 27 (darker colors) and then a multinomial growth model nowcast through July 19 (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 substantially over the last week of June and into the first few days of July. This has resulted in increasing prevalence over this time period, and case counts are starting to increase in multiple counties. Hospitalizations have flattened over this period, and increases are evident in the incomplete data subsequent to July 8. Data from the WA Health system show increases in confirmed COVID-19 admissions over all adult age groups for the week ending July 18. Increases in beds occupied by confirmed or suspected covid admissions have started to increase over this same time period. These increases may in part or wholly be due to an increase in transmission over the June 26 to June 29 heatwave as people remained indoors to escape the heat. If this increase in transmission is not wholly due to this behavior we can expect to see continued increases in cases over July.

Variants of Concern (VOC) continue to spread across Washington state. The recent trends in the three variants (B.1.1.7/alpha, P.1/gamma and B.1.617.2/delta) reflects the relative balance between the increased transmissibility of these variants and the increasing levels of population immunity due to the increasing proportion of the population who are fully vaccinated. The increased transmissibility of B.1.17/alpha over the strains predominant in early March resulted in an increase in cases due to this variant and an overall increase in cases. The increase in proportion of the population with immunity increased quickly starting in March, and a sufficient proportion of the population were immune by mid-May to overcome the increased transmissibility of B.1.1.7/alpha, at which point cases due to B.1.1.7/alpha started to decline. A similar pattern occurred for P.1/gamma, with a lower but slightly later peak, likely reflecting a later introduction into Washington State. The P.1.617.2/delta variant, which is believed more transmissible than either of the B.1.1.7/gamma and P.1/gamma variants, first started to appear in early May, and has since increased to become the predominant strain. This has likely occurred because the current levels of population immunity are not sufficiently high to overcome this increased transmissibility of B.1.617.2/delta. All other things being equal, the increasing predominance of B.1.617.2/delta over July would be expected to result in a small increase in Re (estimated to be between 5% and 7%) due to the increased transmissibility. Over this same time period, population immunity will increase slightly due to additional vaccinations, and to a smaller extent, recent cases. The rate at which immunity will increase however is projected to be small (around 2% at most). All other things being equal, the increase in immunity would be expected to result in a small (around 4%) decrease in Re. The net balance between these two factors suggests that the additional immunity expected to occur over July will not be sufficient on its own to reduce Re. Thus, we can anticipate continued increases in cases, as the delta variant becomes a greater fraction of cases in less vaccinated areas of the state.

The burden of any increases in SARS-CoV-2 in Washington State will be experienced primarily by unvaccinated individuals. Our analysis of hospital admission rates by vaccination status indicates that as of July 4, hospital admission rates among the unvaccinated population 45-64 are 20 times as high as those in the fully vaccinated population in this age group, and in the 65+ population, hospital admission rates are 9 times as high in unvaccinated persons as in vaccinated persons. Although there were declines in admission rates in the unvaccinated population from mid-May through mid-June, due to decreased transmission resulting from the increasing number of Washington residents who became fully vaccinated over this time period, the rates of hospital admissions in unvaccinated individuals remains high. In individuals aged 45 to 64 in particular, the hospitalization rate in the unvaccinated remains higher than the peak hospitalization rates seen in December. These data highlight both the very strong protection

against severe disease afforded by vaccination and the overall benefit to society that results from vaccinations.

The increase in R_e over the last week of June and into early July is concerning. If this is a result of a temporary increase in transmission over the June 26 to June 29 heatwave, R_e may subsequently decrease. However if it remains above one we do not expect that increases in immunity over the course of July will be sufficient to push R_e back below one. Greater population vaccination coverage, as well as continued caution and use of NPI until fully protected by vaccination, remain critical in order to control transmission and prevent increases in cases and hospitalizations.

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 July 18, and to hedge against delays in reporting, we analyze data as recent as July 8 across the state for cases and hospital admissions, and as recent as June 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% (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.