# COVID-19 transmission across Washington State

Washington State Department of Health
April 21, 2021

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# SitRep 31: COVID-19 transmission across Washington State

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***Results as of April 20, 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.

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 8 indicate that COVID-19 transmission is increasing in Washington state.
**Cases:** Overall statewide, case rates are increasing in most age groups, with particularly sharp increases among younger age groups, including ages 10-19, 20-29, 30-39, and 40-49. In addition, case counts are on the increase in over half of all counties.
**Hospital admissions:** Hospital admission rates are increasing among all age groups. Hospital bed occupancy is also increasing.
**Vaccination:** Statewide, vaccination is increasing: nearly 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 over 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 50-60% of cases are currently attributable to B.1.1.7.
**Public health message:** Current trends indicate the state is in the early stages of a fourth surge of infection, with many similarities to early November 2020. With over 70% of the population still susceptible it is critical to maintain firm adherence to masking, social distancing, and avoidance of indoor gatherings.

## ***Statewide estimates of the effective reproductive number***

In this update we have incorporated information on vaccination into model estimates. Using data from the [Washington Disease Reporting System](#) (WDRS) through April 8, we are presenting two versions of the reproductive number (Re) as of April 2. The orange line and orange-shaded region in Figure 1 below shows estimates of Re that measure *only* the effects of population-level behavior on the SARS-CoV-2 transmission rate. This metric describes the impact of behavior on transmission and is comparable across all time regardless of population immunity changes. On April 2, this "behavior-based" Re was likely between 1.33 and 2.11 with a best estimate of 1.72. The green line and green-shaded region shows estimates of total Re which includes contributions from behavior and immunity, either from prior infection or due to vaccination. This "behavior and immunity-adjusted" $R_e$ was likely between 1.00 and 1.58 on April 2, with a best estimate of 1.29. The divergence between the "behavior-based" and total "behavior and immunity-adjusted" Re estimates began in January and have become more evident over time, following the winter wave and as vaccination rates have increased across the state. Notably, both Re metrics are impacted by the introduction of more transmissible variants, which would increase both metrics similarly. The growth rate of the epidemic is determined by the total Re, and so we are seeing that population immunity is beginning to help control the transmission rate. However, immunity is still not sufficient to counteract behaviors that pose transmission risks that are at least as high as those at the steepest part of the winter wave in November, noting that transmission risk is also higher currently than it was in November due to variants of concern. To reduce levels of cases and hospitalizations, the total $R_e$ (green) needs to maintain a value substantially below 1 for a sustained period of time through a combination of population behavior and immunity.

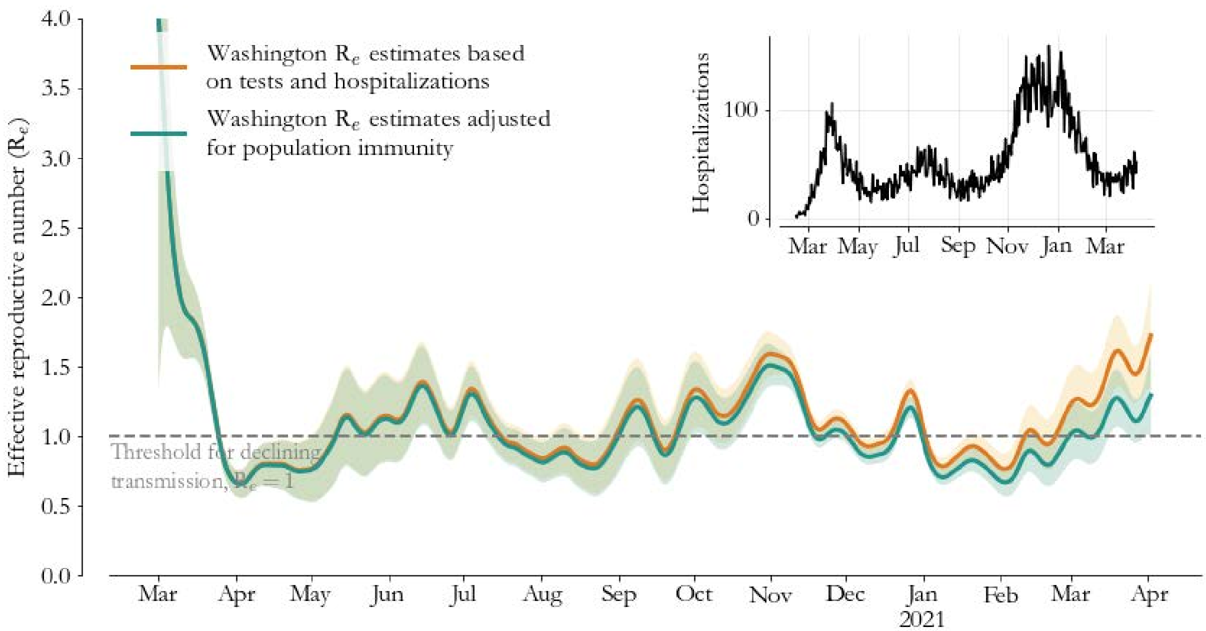


***Figure 1**: estimates for Washington state. The orange line and orange-shaded region indicate the "behavior-based" , while the green line and green-shaded region depict the total "behavior and immunity-adjusted" .*

## *Model-based statewide prevalence*

On April 2, overall prevalence (the percentage of Washington state residents with active COVID-19 infection) in Washington state was likely between 0.21% and 0.35%, with a best estimate of 0.28% (Figure 2). The declines in prevalence that were apparent from early January to late February have flattened through mid-March, and began to increase in late March. Current prevalence has nearly doubled in comparison to its level on March 1.

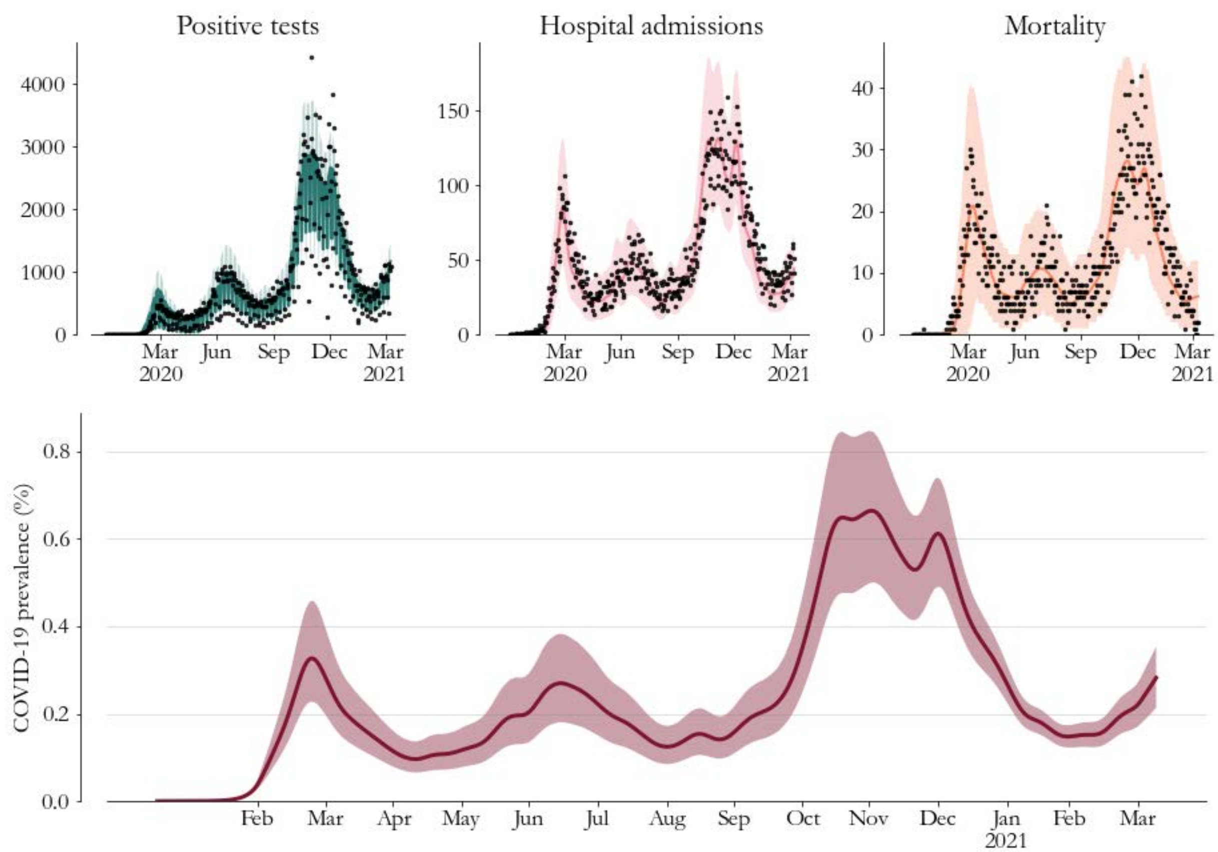


***Figure 2****: Model-based prevalence estimates (bottom, 95% CI shaded) and model fit to cases (top left), hospitalizations (top middle) and deaths (top right) for Washington state. Prevalence is the percentage of Washington state residents with active COVID-19 infection.*

## ***Model-based statewide immunity***

On April 2, we estimate that overall population immunity to SARS-CoV-2 in Washington state was between 24.9% and 28.9% with a best estimate of 26.8%. Approximately 11% of the population derived immunity from prior infection, and roughly 15% from vaccination. Figure 3 indicates that currently, vaccine-derived immunity is just starting to surpass naturally-derived immunity at the population level.

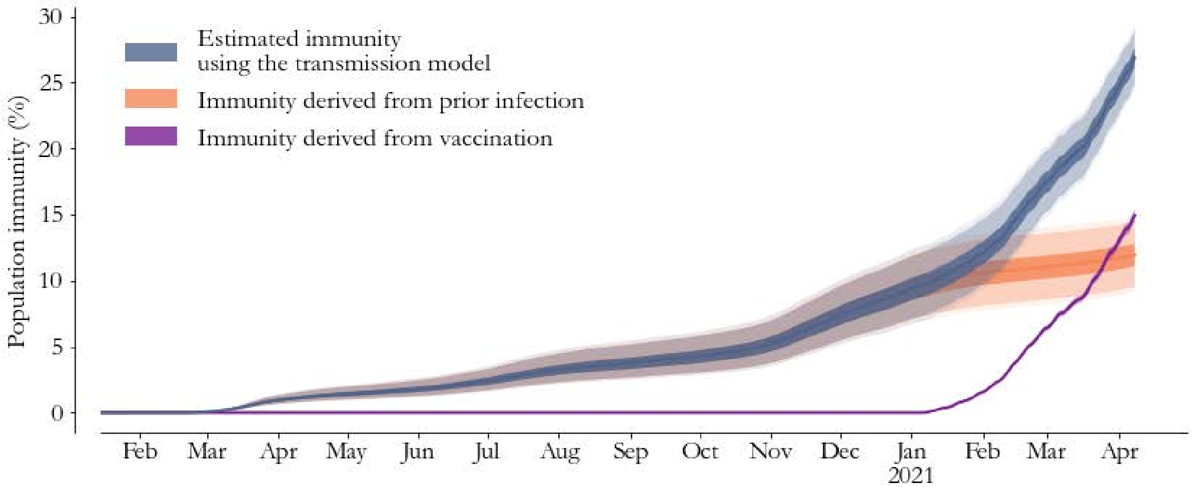


***Figure 3****: Model-based estimates of population-level immunity to SARS-CoV-2 infection as of April 2. Overall population immunity is indicated in the blue line and shaded area. The percent of the population deriving immunity from prior infection, the "natural component," is shown in orange. Note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

*Cases*

Across the state, the declines in case counts that started in early January flattened in mid-February, and began increasing in late March (Figure 4). The seven-day rolling average case count increased from 384 cases per day on September 12 to a 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 1076 cases per day as of April 8.

*Hospital admissions*

Hospital admissions flattened in early March and began increasing in early April. 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 48 as of April 8.

*Deaths*

Deaths have continued to decline through late March. 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 6 as of March 29 (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).

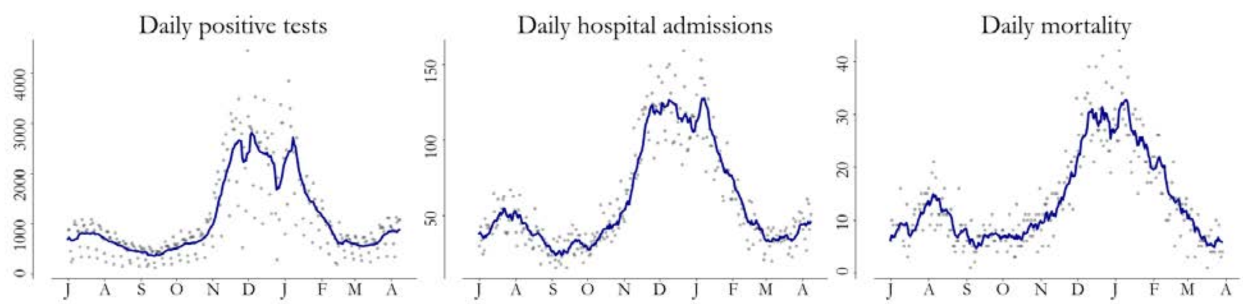


***Figure 4****: Seven-day rolling case counts (left panel), hospital admissions (middle panel) and deaths (right panel) for Washington from July 2020 through April 8 (cases and hospitalizations) and March 29 (deaths) 2021. Because of how confirmed deaths are being reported, we are using an earlier cutoff for the mortality panel.*

## ***County-level trends***

Across Washington state as of April 8, 2 counties had no new cases over the prior two weeks (Columbia, Garfield); 14 counties had 14-day rates of new cases between 100 and 200 per 100,000 people; and 5 counties (Franklin, Pierce, Stevens, Cowlitz, Whitman, Lincoln) had rates between 200 and 300 per 100,000 (Figure 5). Notably, rates in Whitman were slightly above 300 per 100,000, and in Lincoln were slightly above 400 per 100,000. Trends in county-level case counts suggest increasing counts in the majority of counties:

- In all of five largest counties (Clark, King, Pierce, Snohomish, Spokane) case counts have continued to increase.
- Case counts are increasing in all medium-sized counties except for in Whatcom and Yakima where counts remain fairly flat.
- Case counts in Whitman continue to decline after a peak in mid-March. All other small counties still have fewer than 10 counts per day, on average, but increases are evident in Clallam, Kittitas, Lewis, Stevens, Jefferson, Klickitat, Lincoln, Pacific, San Juan, and Skamania.

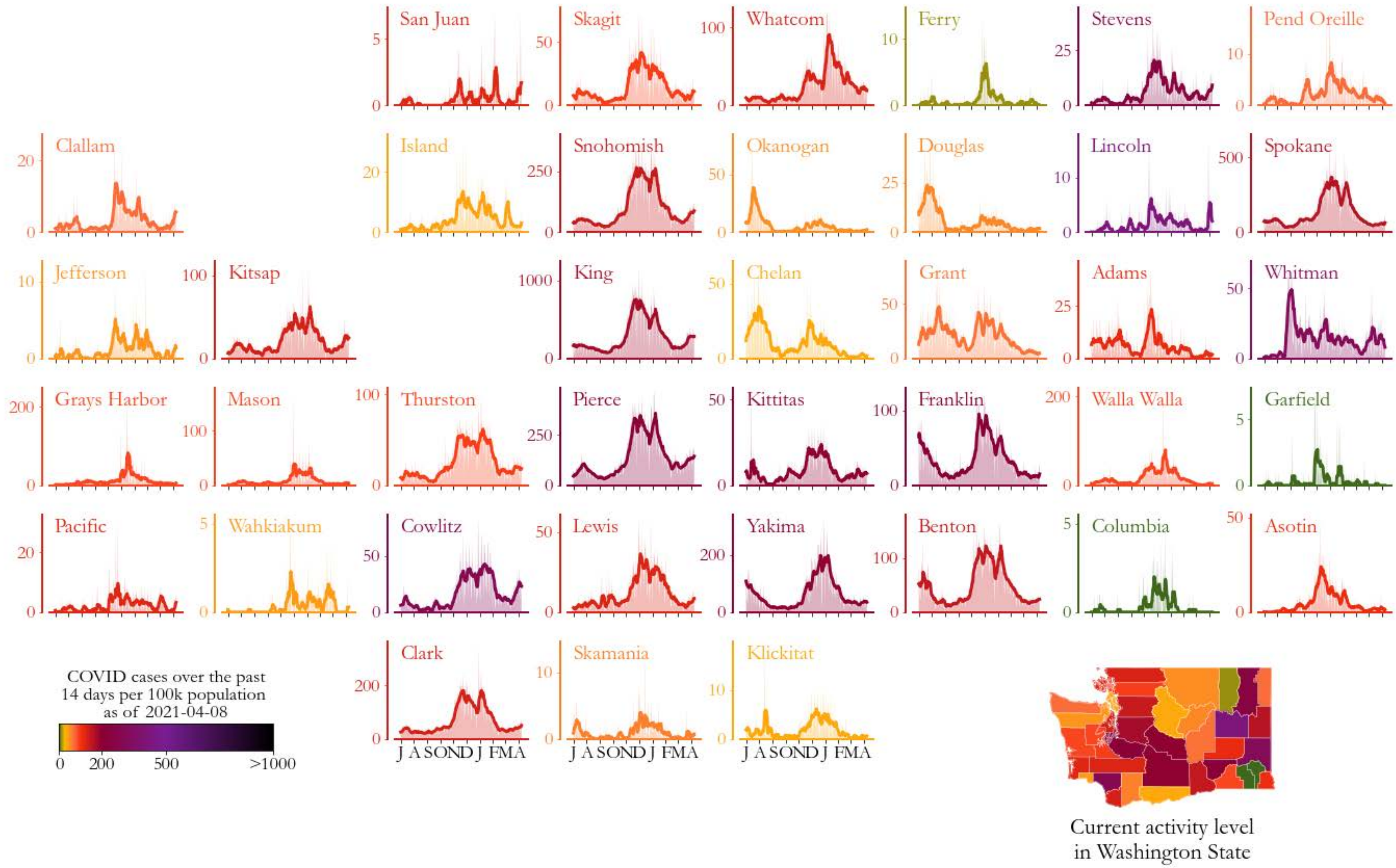


***Figure 5**: Daily COVID-19 positives (shaded areas) and 7-day moving averages (curves) arranged geographically and colored by COVID-19 activity level (total cases from March 26 to April 8 per 100,000 people). Case trends across counties highlight geographic correlations and help us better understand region-level estimates of the transmission rate (see Figure 1).*

## ***Trends in case rates by age group***

Across Washington state, 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 8, case rates are increasing in all age groups except for ages 70-79 and 80+. Particularly sharp increases are evident for youths aged 10-19 and adults aged 20-29, 30-39, and 40-49, among whom case counts are highest. Shallower increases are apparent among children aged 0-9 and adults aged 50-59 and 60-69. Until mid-March, children aged 0-9 consistently had the lowest case rates, but have subsequently surpassed the rates observed in the 70-79 and 80+ age groups.

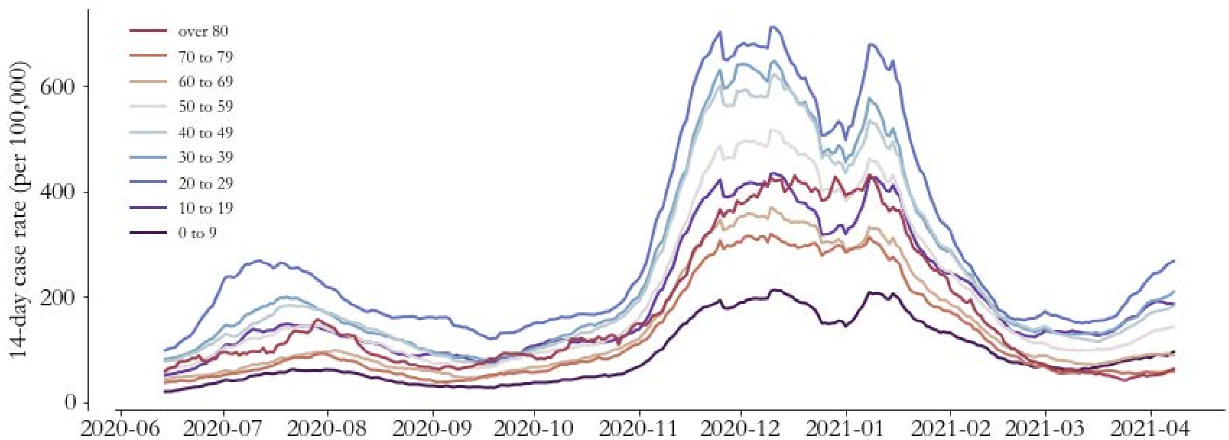


***Figure 6.*** *14-day case rates by 10-year age group across Washington state, as of April 8, 2021.*

We expect a more rapid decline in cases over age 60 as the proportion of vaccinated individuals in this age range increases compared to age groups in which a smaller proportion have been vaccinated.  This is evident 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.

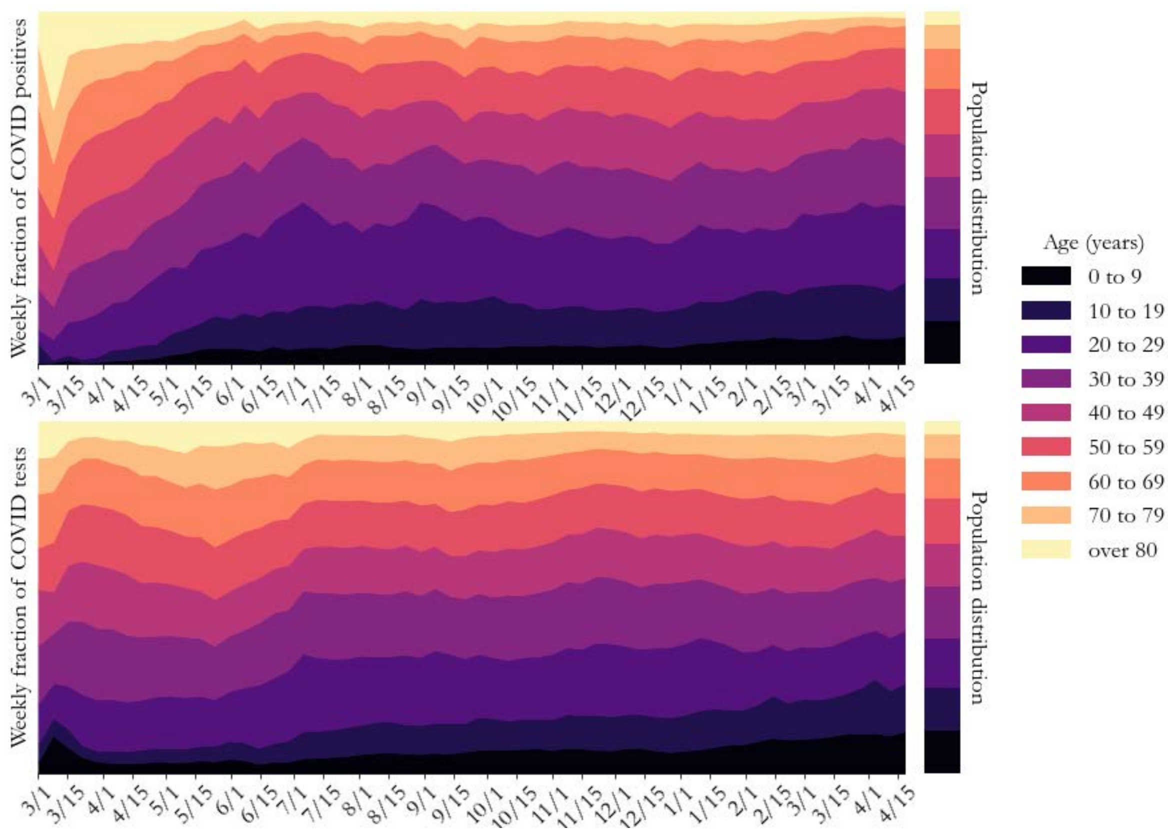


***Figure 7.*** *The top panel of this graph shows the weekly age distribution of COVID-19 cases and the bottom panel shows the weekly age distribution of COVID-19 tests.  The colors represent 10-year age groups. Early in the pandemic, populations over age 60 represented a greater fraction of total COVID-19 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 have declined since early January among all age groups. The top panel of Figure 8 shows the highest hospital admission rates and steepest drops in rates since January among the 70-79 and 80 and over age groups (the age groups at greatest risk for severe disease) potentially because those age groups were among the first to be vaccinated. The bottom panel of Figure 8, which shows the rates on a log scale, indicates that declines in hospital admission rates occurred across all age groups from January until around mid-March. However, as of April 8, hospital admission rates are increasing across all adult age groups.

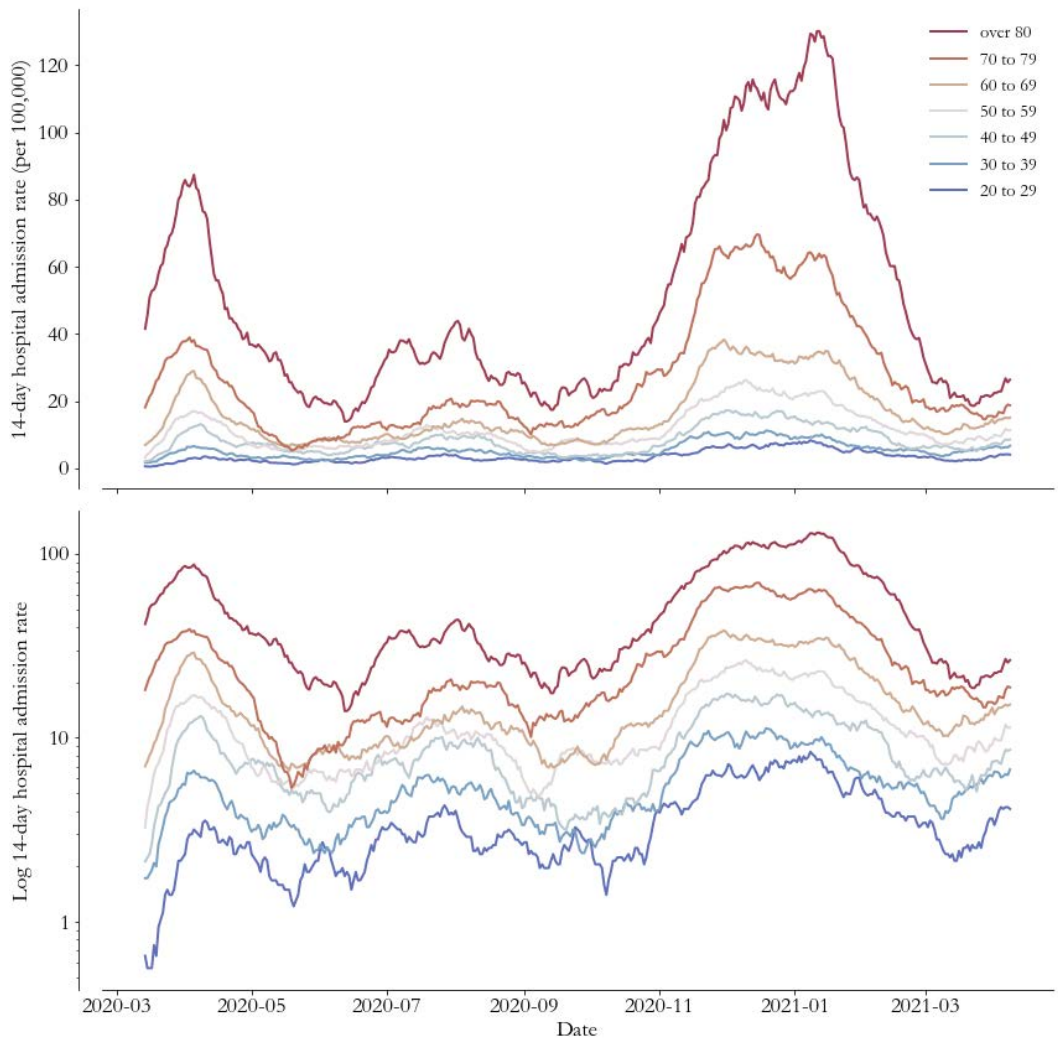


***Figure 8.*** *Statewide 14-day hospital admission rate per 100,000 population by 10-year age group as of April 8. The top panel shows the rates on a standard numeric scale, and the bottom panel shows the rates on a log scale to be able to better compare the rate of decline between age groups that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

In order to assess the impact of vaccination on hospital admission rates among adults aged 60 and over, we compared the declines in hospital admission rates between ages 60 and over and 0-59 after the August peak and after the January peak in hospital admissions.  The trend lines in the left panel of Figure 9 show the percent of the August peak for each of the age groups, and those in the right panel show the percent of the January peak admission rates for the two age groups.  This figure indicates that the rate of decline after the August peak was faster among those 0-59 years in comparison to those over age 60, whereas the rate of decline after the January peak was more rapid among the 60 and over age group in comparison to the younger age group.  This difference in the rate of decline after the January peak is most likely attributable to the protective effects of vaccination in the 60 and over population, which was among the first groups to be vaccinated.  Recent data through April 8 shows that while the decline from the January peak has flattened among ages 60 and over, the 0 to 59 year old age group is now seeing an upswing.

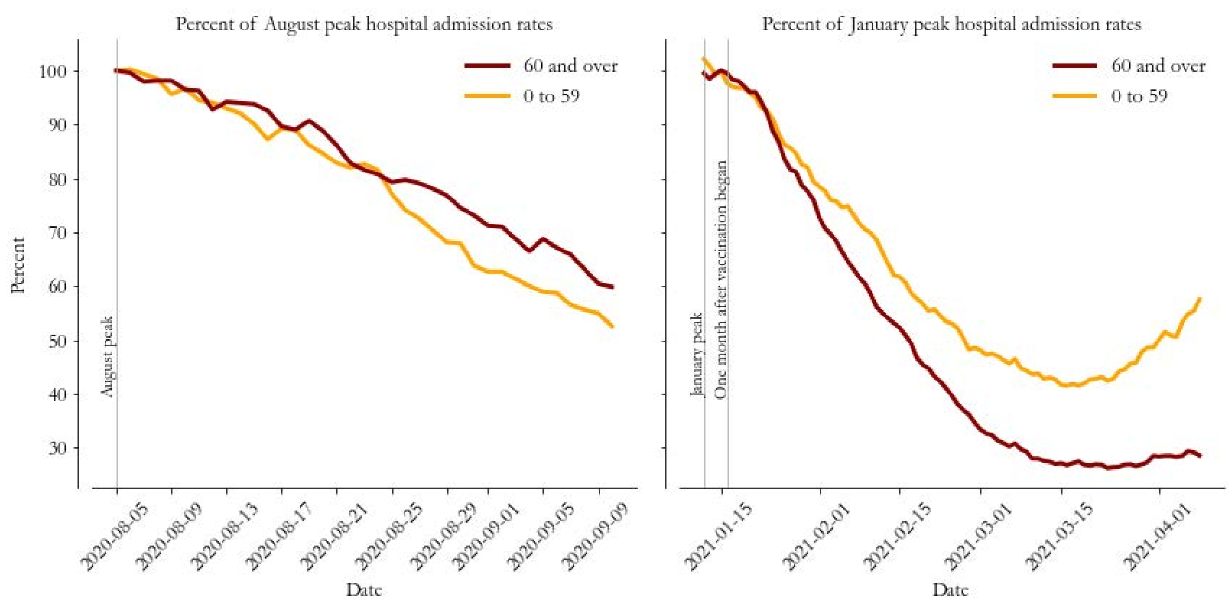


***Figure 9.*** *Comparison of declines in hospital admission rates after August (left panel) and January (right panel) peaks in hospital admissions, between ages 60 and over (dark red line), and ages 0 to 59 (orange line).*

## *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 a gradually increasing trend is again evident.

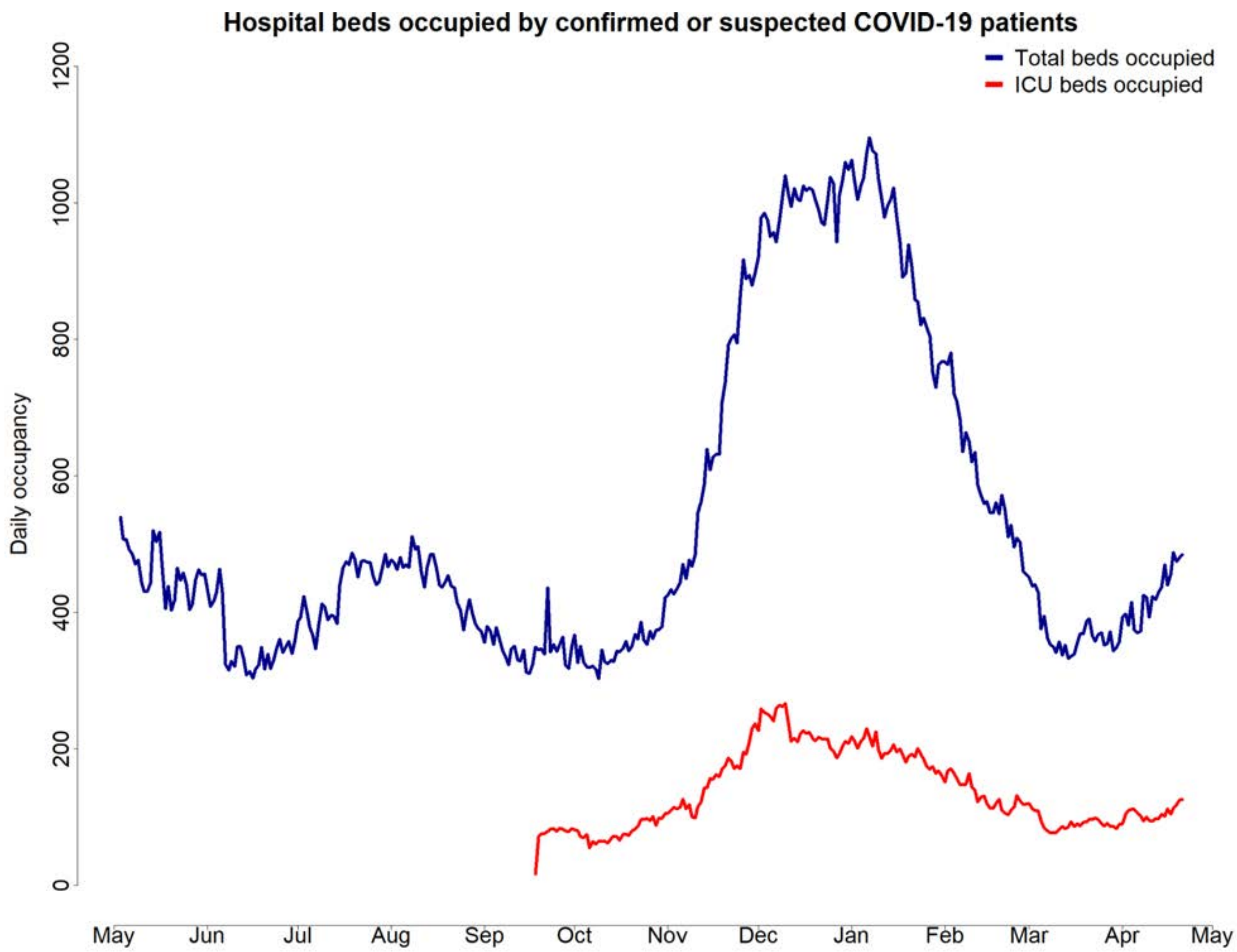


***Figure 10.*** *Total hospital beds and ICU beds occupied by confirmed or suspected COVID-19 patients reported through the WA Health system. Data collection for ICU beds occupied by COVID-19 patients started September 17. Hospital occupancy data has minimal reporting lag, and is shown here using data up to April 19. 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 March 27, and using a multinomial logistic growth model, we estimate that on April 20, roughly 50-60% of cases are attributable to B.1.1.7, and about 30% are due to B.1.429, B.1.427, and P.1 (Figure 11). As B.1.1.7 has a faster doubling time than B.1.429, the other major VOC in Washington state, it will likely outcompete B.1.429 in the near future. Also note that the P1 growth rate estimate is based on limited data and may be inflated due to case clustering biases. 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.

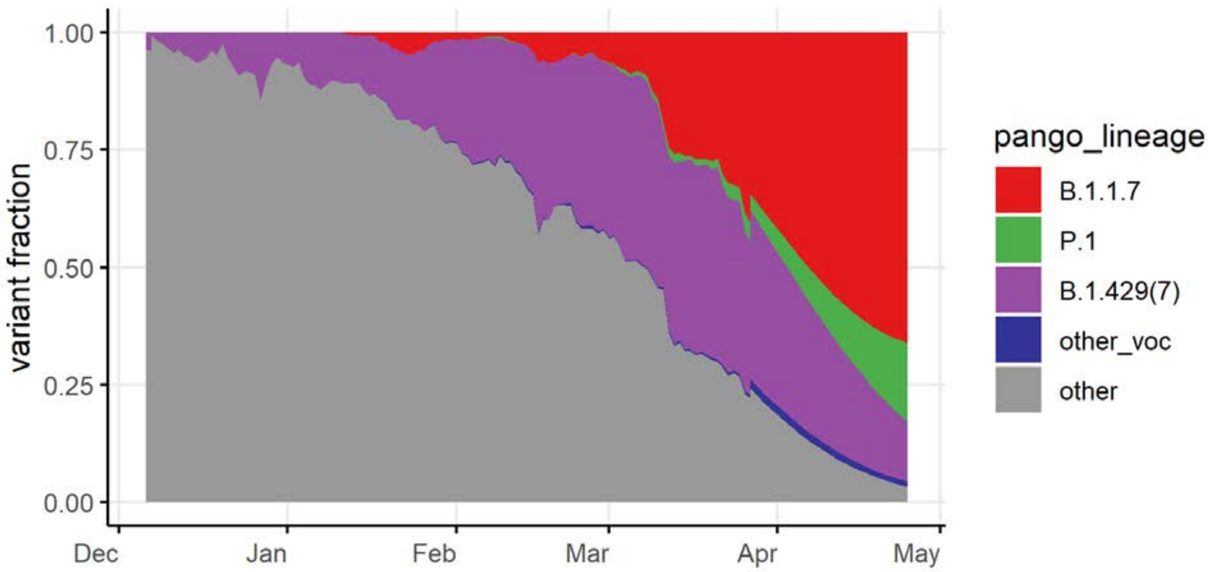


**Figure 11**. Estimated fraction of cases attributable to variants of concern in Washington State. Data used in this analysis exclude sequences obtained by targeting B.1.1.7. Figure shows seven-day running average through March 27 and then multinomial logistic growth nowcast through April 20. For the figure, variants of interest B.1.427 and B.1.429 have been combined as they are closely related, and the label "other VOC" includes B.1.351 and others of interest.

## *Implications for public health practice*

Across Washington state, transmission is increasing, Re remains above one even after adjusting for population immunity, and we are in the early stages of a fourth wave of cases. Case rates are increasing in all but the oldest age groups, with particularly sharp increases among younger age groups, and case counts are on the increase in the majority of counties. Similarly, hospital admission rates are increasing in all age groups including among those over age 60, and sharp increases are evident among younger adults. In addition, total beds occupied by COVID-19 patients are on the increase, though hospital capacity remains sufficient.

Vaccination rates across Washington state remain steady at around 60,000 doses/day, and as of April, the proportion of the population protected by vaccine-derived immunity has surpassed the proportion protected by immunity from prior infection. The effectiveness of vaccination in preventing severe disease and death has been well-established. However, in Washington state, nearly a quarter of the population over age 65, who are at greatest risk of severe disease and death, have yet to initiate vaccination despite having been eligible since February. Further, 70% of the overall population still remain susceptible, though this is likely to decrease in the coming weeks as vaccination eligibility has opened to the population as whole.

Variants of Concern (VOC) continue to spread across Washington state, and currently, the B.1.1.7, B.1.427, and B.1.429 VOC comprise the greatest proportion of circulating variants in the state. Among these, the most significant threat is posed by B.1.1.7 due to its greater transmissibility and disease severity. With B.1.1.7 at or above 50% statewide, and the majority of the state's population still susceptible, it is clear that non-pharmaceutical interventions, such as effective masking and social distancing, are essential to protect the health of the public.

In combination, these trends indicate that the state is at the beginning of a fourth surge of infection. As indicated by current trends in "behavior-based" $R_e$ and "behavior and immunity-adjusted" $R_e$, the severity of this surge depends not only on the rate of vaccination of the population, but also in large part on population behavior, particularly continued social distancing, consistent use of masking, and avoidance of indoor gathering unless fully vaccinated.

## *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 April 18, and to hedge against delays in reporting, we analyze data as recent as April 8 across the state for cases and hospital admissions, and as recent as March 29 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.