

COVID-19 transmission across Washington State

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SitRep 23: COVID-19 transmission across Washington State

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Results as of December 23rd 2020.

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

Using data from the [Washington Disease Reporting System](#) (WDRS) through December 11, we estimate the effective reproductive number (R_e) in western Washington on December 5 was likely between 0.91 and 1.15, with a best estimate of 1.03. Meanwhile, we estimate that in eastern Washington, R_e was likely between 0.96 and 1.26, with a best estimate of 1.11 (Figure 1).

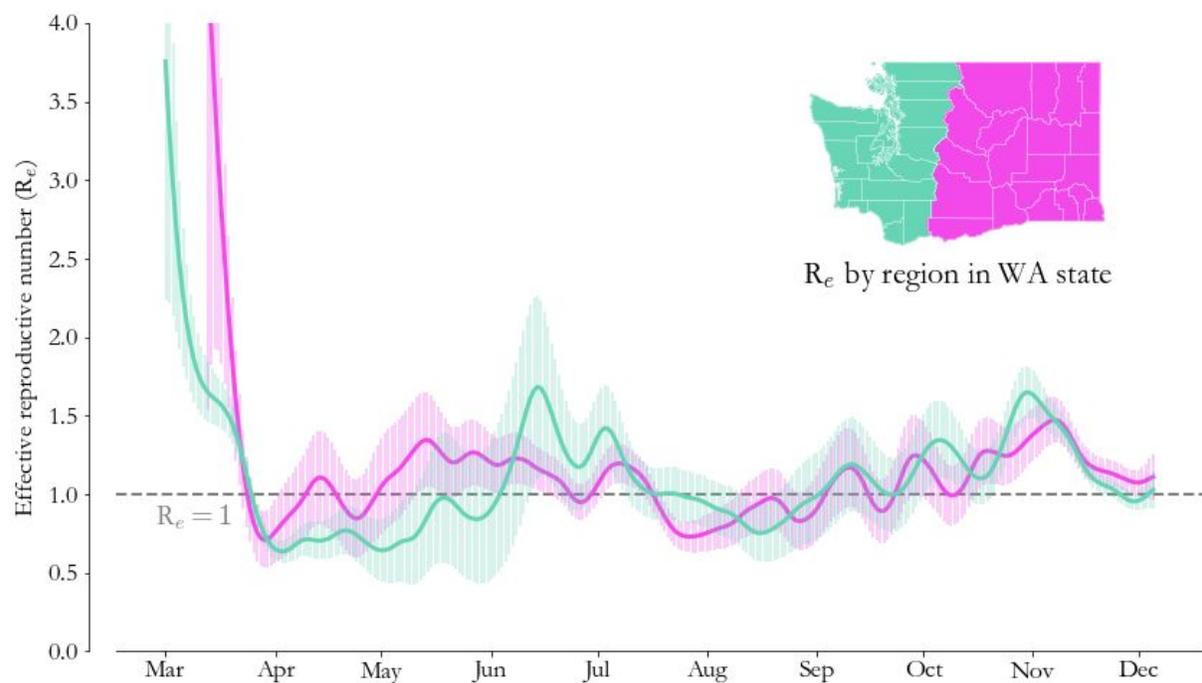


Figure 1: R_e estimates for eastern (pink) and western (green) WA, with 2 standard deviation error bars. Our most recent estimates show R_e has decreased in both eastern and western Washington since peaks in late October (western Washington) and early November (eastern Washington) to values at or slightly above 1. To reduce levels of cases and hospitalizations, R_e needs to drop to a value substantially below 1 for a sustained period of time.

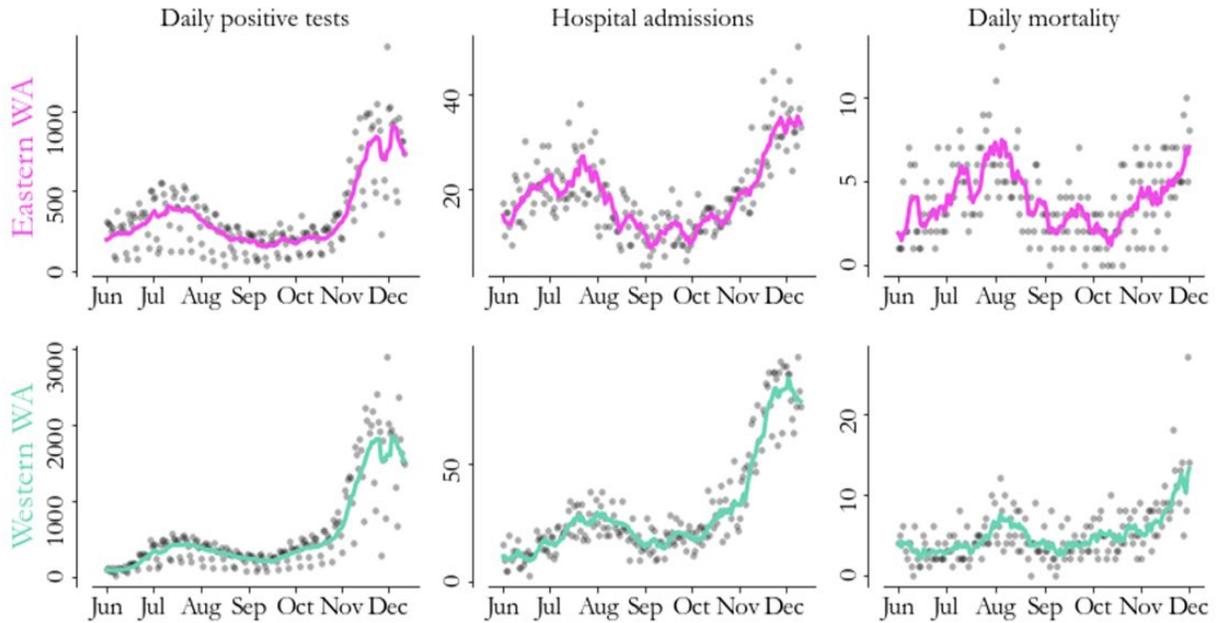


Figure 2: Seven-day rolling case counts (left panels), hospitalizations (middle panels) and deaths (right panels) for eastern Washington (top) and western Washington (bottom) through December 11 (cases and hospitalizations) and November 30 (deaths). Because of a change in how confirmed deaths are being reported, we are using an earlier cutoff for the mortality panel.

Details

The steep increases in case counts and hospitalizations that occurred over the first two weeks of November in both eastern and western Washington started to plateau just prior to the week of Thanksgiving (Figure 2). The drop in cases that occurred over the week of Thanksgiving were likely due to changes in test-seeking behavior rather than representing actual drops in prevalence. A similar but proportionally smaller drop in hospitalizations was observed over the same week, likely due to reductions in healthcare-seeking behavior that typically occur over the week of Thanksgiving. Subsequent to Thanksgiving both numbers of cases and hospitalizations rebounded to levels seen immediately before Thanksgiving. Cases in both eastern and western Washington have since shown some reduction, as have hospitalizations in western Washington. Hospitalizations in eastern Washington over that same time period have remained level. Deaths in both eastern and western Washington continued to rise through the end of November.

The seven-day rolling average case count in eastern Washington increased from 168 cases per day on September 13 to 1022 on December 4, and declined to 859 as of December 11. This trend of growth through early December, followed by some flattening in counts has been mirrored in daily hospital admissions, which showed a three-fold increase from early September through early December, with the seven-day rolling average hospitalizations flattening at around 36 admissions per day thereafter.

Case counts in western Washington have steadily risen since September 12, increasing from a seven-day moving average of 208 cases per day on September 12, to 496 cases on October 24, to 1886 cases on December 4. However, recent flattening in case counts is evident, as the seven-day rolling average declined to 1551 as of December 11. Daily hospitalizations in western Washington have been increasing since the beginning of October, from a seven-day rolling average of 15 admissions per day on October 3 to 81 on December 4, with slight flattening evident recently, with seven-day average daily admissions of 76 as of December 11.

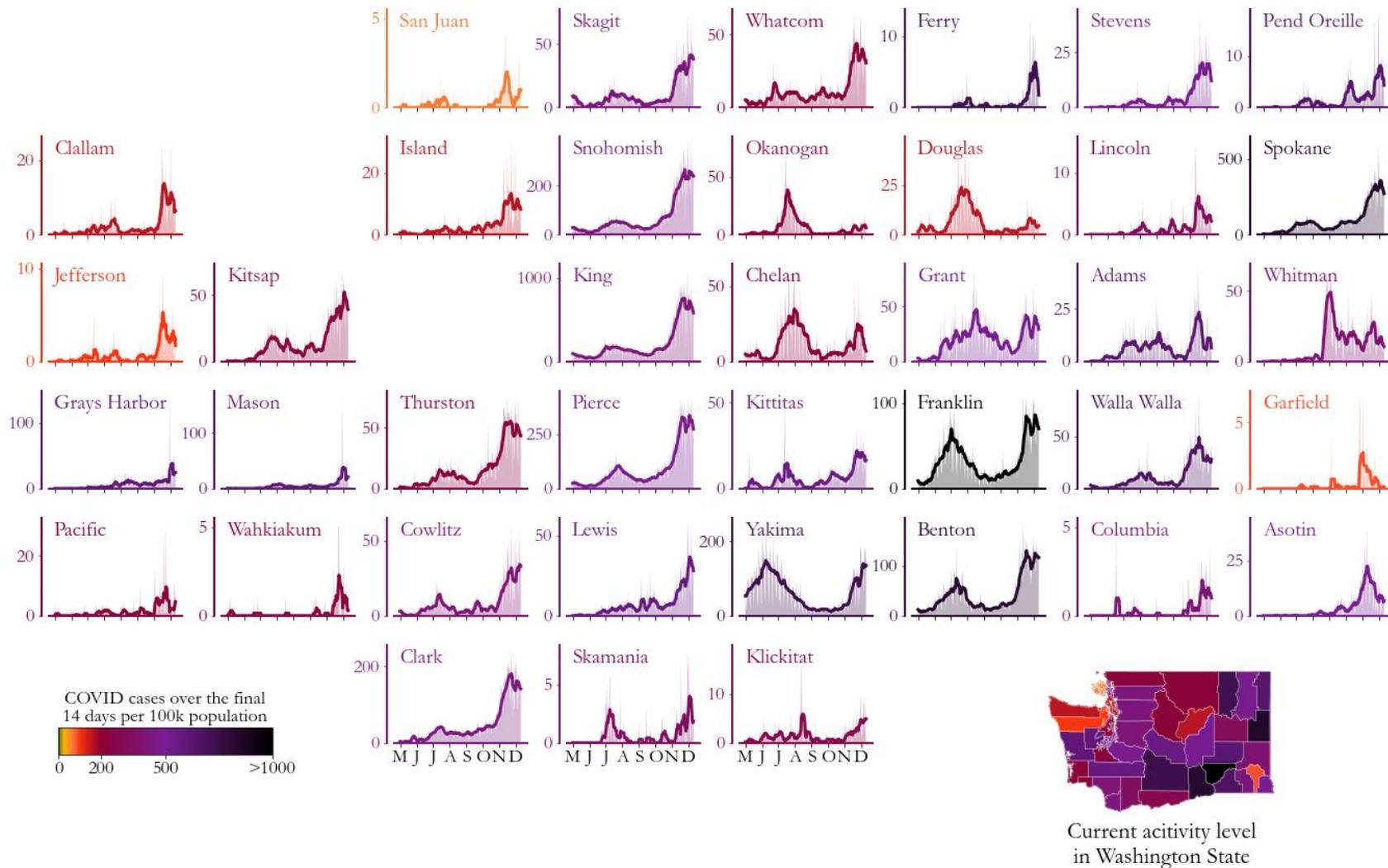


Figure 3: Daily COVID-19 positives (shaded areas) and 7-day moving averages (curves) arranged geographically and colored by COVID-19 activity level (total cases from November 28 to December 11 per 100,000 people). Case trends across counties highlight geographic correlations and help us better understand region-level estimates of the transmission rate (see Figure 1). A temporary reduction in case counts was observed over the week of Thanksgiving in many counties, with subsequent rebounds evident in some counties. As of December 11, case counts show signs of flattening in some counties, but cases per 100,000 people remain high in most counties as of December 11.

Absolute case rates remain high across Washington state, with 31 of 39 counties showing 14-day rates of new cases above 200 per 100,000 population, and 16 of 39 counties above 500 per 100,000 population (Figure 3).

- Our five largest counties (Clark, King, Pierce, Snohomish, and Spokane) have seen recent declines in counts.
- Some medium-sized counties (Franklin, Thurston, Whatcom) show recent declines in case counts to mid-November levels. Benton and Cowlitz counties show flattening in counts to pre-Thanksgiving levels. A few other mid-sized counties (Grant, Kitsap, Skagit, Yakima) show some flattening, but case counts still remain higher than just prior to Thanksgiving.
- Several small counties (Chelan, Kittitas, Stevens, Whitman) show recent declines to mid-November levels of case counts. Additional counties (Douglas, Okanogan, Walla Walla) show flattening to pre-Thanksgiving levels. Several other small counties (Grays Harbor, Lewis, Mason) show flattening/declines but absolute counts still remain higher than before Thanksgiving.

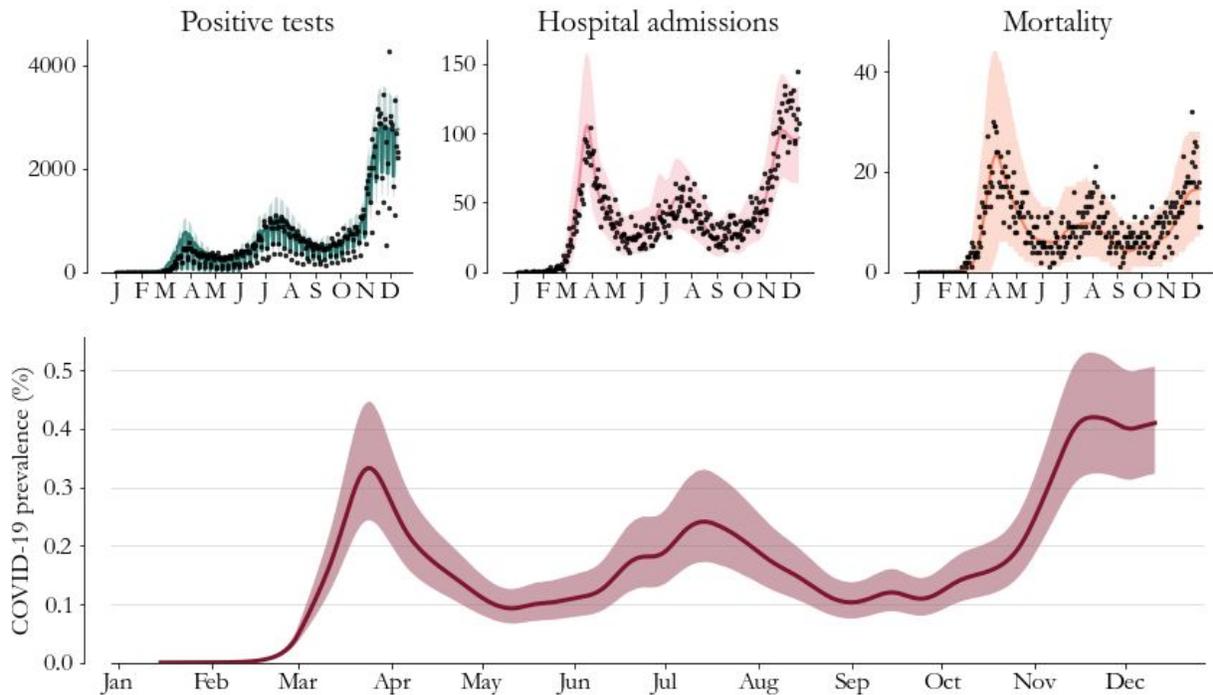


Figure 4: Model-based prevalence estimates (bottom, 95% CI shaded) and model fit to cases (top left), hospitalizations (top middle) and deaths (top right) for Washington state. Prevalence is the percentage of Washington state residents with active COVID-19 infection.

On December 5, overall prevalence (the percentage of Washington state residents with active COVID-19 infection) in Washington state was likely between 0.32% and 0.51%, with a best estimate of 0.41% (Figure 4). This estimate is higher than the peak estimate in late March, and hospital admissions at the end of November surpassed March levels. Deaths remain substantially lower than the March peak. Prevalence estimates started to flatten in mid-November, however, consistent with an R_e staying at or slightly above 1, prevalence remains several times higher than it was at the start of October. The slight drop in late November may be related to changes in healthcare-seeking behavior rather than real drops in prevalence. The combined observations of both higher current prevalence than in mid-March and fewer severe outcomes is consistent with evidence that the infected population is generally younger now than in mid-March and that advances in treatment have improved survival. Hospitalizations and deaths generally occur some time after initial infection, so the most recent hospitalization admission rates reflect exposure that occurred at least 4 or 5 days earlier.

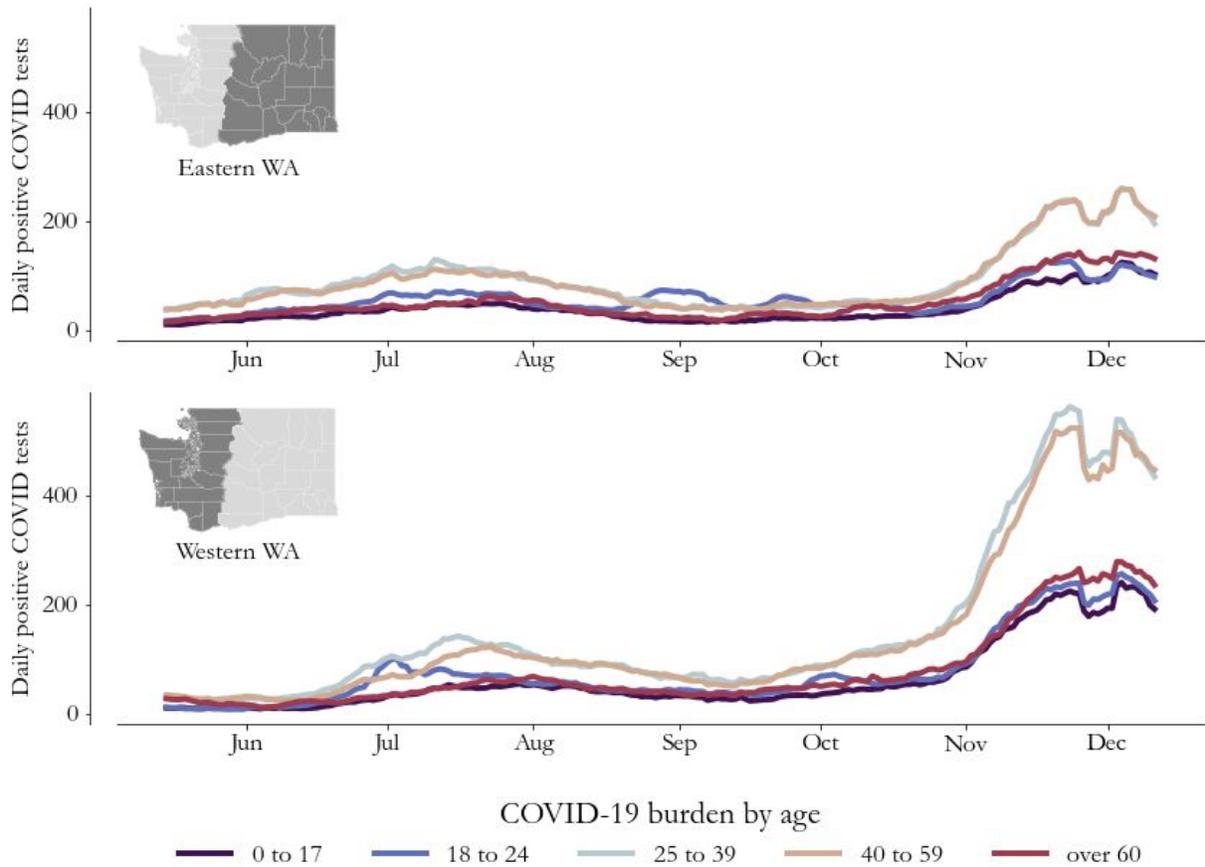


Figure 5. Seven-day rolling average case counts by age group for eastern Washington (top) and western Washington (bottom) showing that recent decreasing trends are distributed across age groups.

The increase in case counts that was observed in all age groups in both eastern and western Washington over the first two weeks of November started to plateau just prior to Thanksgiving (Figure 5). The substantial drops in cases that occurred over the week of Thanksgiving occurred in all age groups, however this drop was smaller in those over 60. The post-Thanksgiving rebound occurred in all age groups in both eastern and western Washington, followed by reductions in all age groups over the week ending December 11.

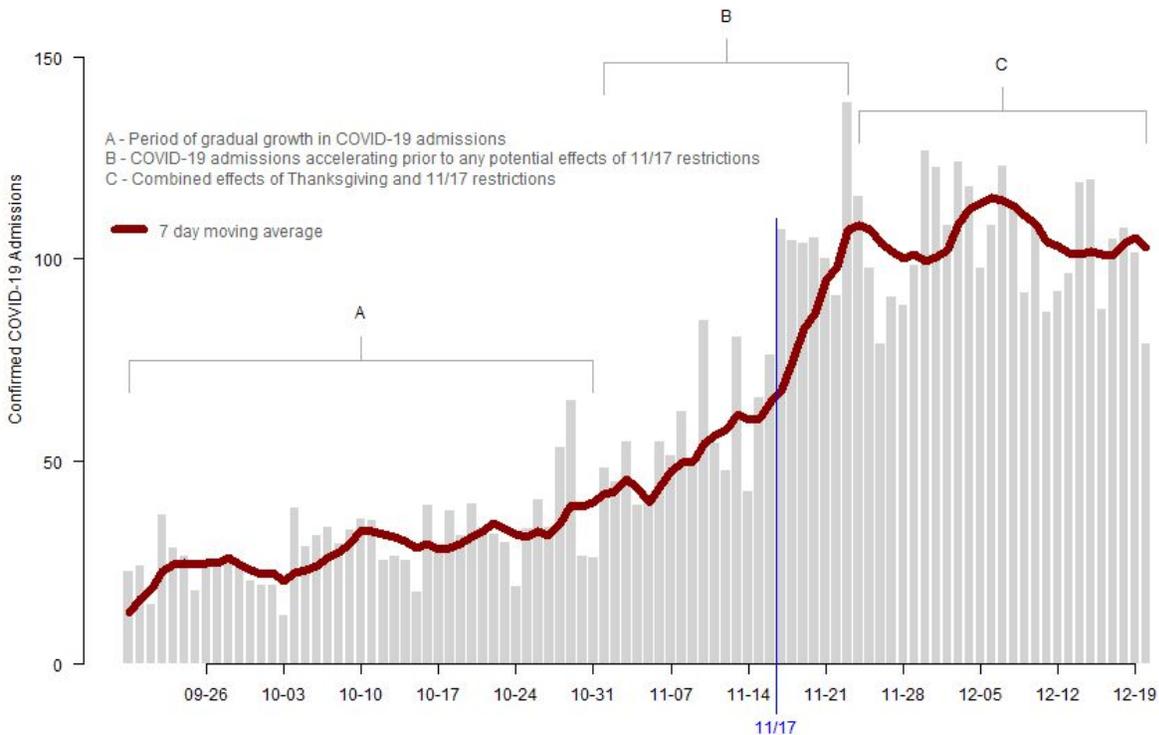


Figure 6. Hospital admissions for patients with confirmed COVID-19 infections reported by hospitals through the WA Health system from October 19 to December 21. Through the WA Health system, hospitals report the daily numbers of admissions for confirmed COVID-19 admissions the previous day, as well as the number of staffed acute-care ICU beds currently occupied by confirmed and suspected COVID-19 patients. Renewed restrictions went into effect on November 17 (blue line).

This week we are including data on aggregate daily hospital admissions reported through the WA Health system. These data are more timely than the hospitalization data used to estimate R_e and prevalence, however, the WA Health data do not distinguish between patients with confirmed COVID-19 who require hospitalization because of COVID-19 symptoms and patients admitted for other reasons who test positive for COVID-19. This makes it less suitable for model based estimation of R_e and prevalence as our model is based on severe COVID-19 infections requiring hospitalizations. Figure 6 illustrates three distinct time periods: (A) a gradual increase in hospital admissions through October 31, (B) a period of accelerating admissions through November 23, and (C) the subsequent time period that includes the combined effects of Thanksgiving and reductions in transmission (R_e) that started in mid-November. Because COVID-19 symptoms do not occur until several days after infection, and because hospitalizations tend to occur several days after the onset of symptoms, hospital admissions continued to climb through November 23 despite the reduction in transmission that occurred in mid-November. A drop in hospital admissions can be observed over the week of Thanksgiving, followed by a post-Thanksgiving rebound. Since the start of December, admissions have remained relatively flat.

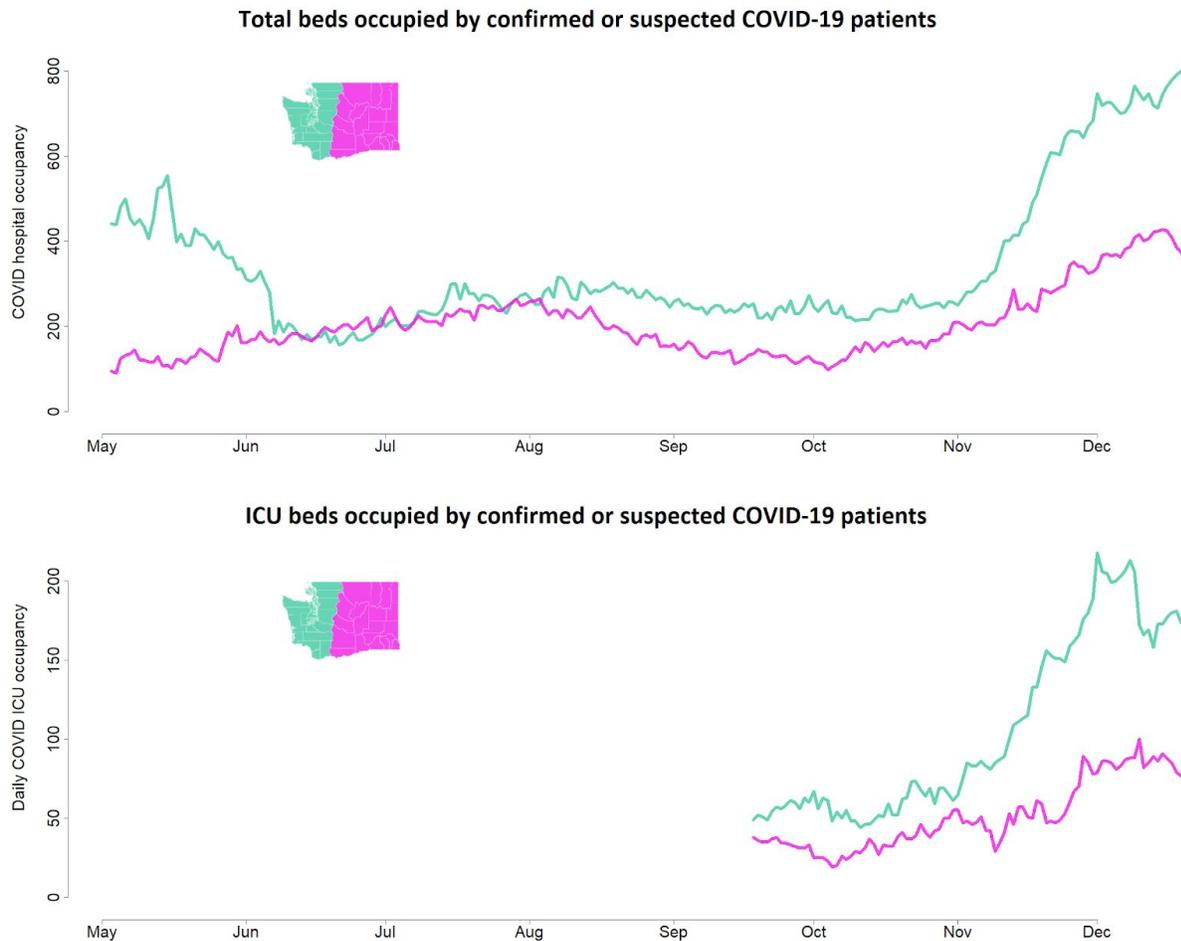


Figure 7. Hospital beds occupied by confirmed or suspected COVID-19 patients (top, western Washington hospitals indicated by the green line, eastern Washington hospitals indicated by the pink line) and ICU beds occupied by COVID-19 patients (bottom) reported through the WA Health system. Data collection 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 December 21. 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 continue to increase for a period of time even after admissions level off since patients being treated for COVID-19 generally stay in the hospital for several days.

In western Washington the rapid increase in the number of occupied hospital beds that started in early November slowed substantially in early December (Figure 7). The slower increase that was occurring eastern Washington remained unabated until mid-December. ICU beds occupied by confirmed or suspected COVID-19 patients plateaued in western Washington at the start of December, followed by a drop mid-December. In eastern Washington the number of ICU beds occupied has remained flat since the start of December.

Implications for public health practice

It is clear that transmission of COVID-19 since mid-November has decreased sufficiently to flatten the exponential growth in cases and hospitalizations that was occurring in the first half of November. The timing of this reduction, starting just before the week of Thanksgiving, is consistent with the indoor dining and gathering restrictions that went into effect on November 17. Over the week of Thanksgiving, travel and gatherings were substantially lower than in previous years, with [King, Pierce, Snohomish and Spokane counties seeing greater than 60% reductions in contacts on Thanksgiving compared to Thanksgiving 2019](#). This reduction appears to have been sufficient to prevent a large Thanksgiving-related increase in transmission in early December.

Although substantial reductions in transmission have been observed, this reduction has not been sufficient to reverse increases in prevalence or hospitalizations, and daily hospital admissions have remained relatively flat over the first three weeks of December. This means Washington State remains in a highly precarious situation, with prevalence at the same level as it was in mid-November, and daily hospitalizations at a higher level than they were in mid-November. Hospitals and ICUs across the state continue to have high occupancy, despite reductions in non-urgent procedures. Any relaxation in the behaviors that have successfully lowered transmission over the previous month would again result in exponential growth in cases and hospitalizations, but starting from a much higher baseline level than the start of November. Daily hospital admissions were projected to double every two weeks if transmission had remained at levels seen at the start of November. If this rate of increase were to occur starting at current levels, COVID-19 admissions would overwhelm hospital capacity in a matter of weeks. To ensure that this does not occur, reductions in travel and gatherings over the upcoming holiday season will be as necessary as they were over Thanksgiving. In addition, with the emergence of a potentially more infectious [new strain of COVID-19](#) in the United Kingdom, South Africa, and other nations, new Washington state travel quarantine restrictions [announced on December 21](#) need to be firmly followed to prevent introduction and spread of this strain in our communities.

Public health advice to stay at home can be followed more easily by higher-income workers than by essential workers, who cannot work from home and must often use public transportation to access their jobs. In addition, Black and Hispanic workers make up a large part of the essential workforce and have been [disproportionately impacted by COVID-19](#). While workplace protections are critical for essential workers, increases in prevalence inherently increases the risk that essential workers face. Individuals who are not essential workers but who make choices that increase the risk of transmission such as attending or holding gatherings with non-household members or not following social distancing guidelines, are making choices that increase the risk and burden faced by the essential workers who keep our communities functioning. As a state, we need to continue to work together by staying apart this holiday season.

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, hospitalization, and death data compiled on December 20, and to hedge against delays in reporting, we analyze data as recent as December 11 across the state.** 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.

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, Niket Thakkar of IDM 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.