

COVID-19 in Colorado, 1/25/2022

Prepared by the Colorado COVID-19 Modeling Group

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Key Messages

- Based on Colorado data, and trends in other places, it is likely that infections and hospitalizations have peaked statewide and will continue to decline in the weeks ahead. We estimate infection prevalence will be below 1% by the end of February.
- We estimate that 1 in every 19 Coloradans (5%) is currently infected. While there is considerable uncertainty around that estimate, all evidence indicates infection prevalence in January 2022 is at unprecedented levels in Colorado. Community transmission remains high, presenting substantial risks to the unvaccinated and those at high-risk of severe COVID-19.
- Our model and other models project a rapid decline in COVID-19 hospital demand in the weeks ahead. However, some locations we are tracking, such as Gauteng Province in South Africa and London, have seen a slower decline in hospital demand for uncertain reasons.
- We anticipate that COVID-19 hospitalization counts will decline over the month of February but there is uncertainty regarding the rate of decline.
- Immunity to Omicron is high and rising at present among Coloradans. We estimate approximately 80% of the population will be immune to Omicron by mid-February.
- We expect a lull in COVID-19 in Colorado over the next few months that could reach into the summer, depending on when new variants emerge. This presents a window of opportunity to increase access to testing and KN95 or N95 masks, and to enhance vaccination uptake to prepare for the next surge.

Introduction

Colorado has been in the midst of an unprecedented surge of COVID-19 due to the Omicron variant since mid-December. This report is written as the Omicron epidemic curve has finally begun its descent. The purpose of this report is to answer key questions about the Omicron epidemic in Colorado in the short-term and the likely course of the pandemic in the state for the longer term. These questions are:

- How quickly will COVID-19 hospitalizations and SARS-CoV-2 infections decline?

- What will happen with COVID-19 hospital demand and infection prevalence over the next 6 to 8 weeks?
- What will happen across the remainder of the winter and into the spring? Have we reached a high enough rate of immunity to end the pandemic in Colorado, at least for now?

To answer these questions, we use COVID-19 hospital, vaccination, and case data and a mathematical model of the epidemic of the virus tailored to Colorado. We also analyze the course of the pandemic in other places in the United States and other countries that began their omicron wave before Colorado. The experience of other locations with omicron can serve as a leading indicator for what may happen in Colorado.

Key message 1. The number of people infected with the Omicron variant of SARS-CoV-2 in January 2022 is at unprecedented levels.

The spread of the highly transmissible Omicron variant in Colorado has led to unprecedented numbers of reported SARS-CoV-2 cases and a very high number of Coloradans being infected in January 2022. **We estimate that 1 in 19 Coloradans (about 5%) are currently infected with SARS-CoV-2 (Figure 1).** There is considerable uncertainty around this estimate of infection prevalence; however, all evidence indicates infection prevalence in January 2022 is at unprecedented levels. For comparison, previous peaks of prevalence were around 2% and during the troughs of infection, the prevalence of infected people was well below 1%. With this high level of infection in Colorado, there is a high risk of encountering someone with SARS-CoV-2. However, that risk will drop week by week (see Key Message 2). We note that infection prevalence varies across the state as some regions have peaked more recently and have higher levels of infection than other regions.

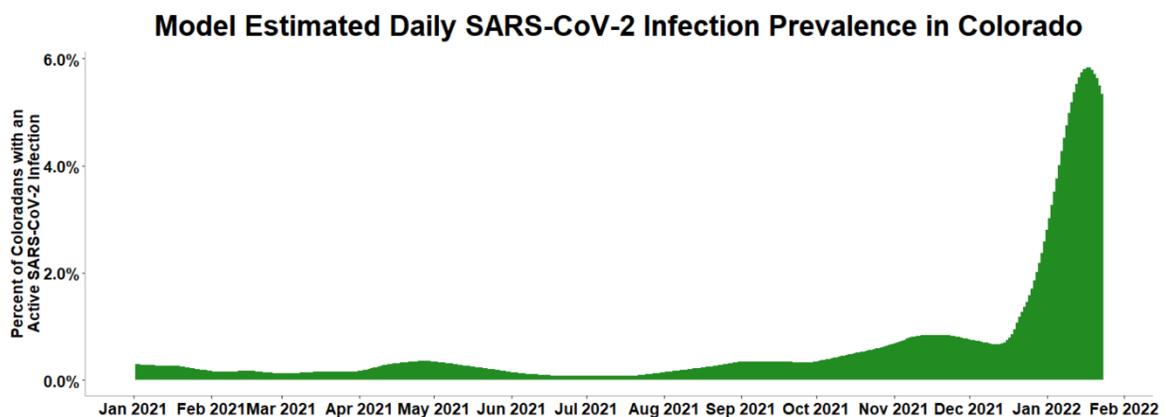


Figure 1. Estimated prevalence of SARS-CoV-2 infection in Colorado from January 2021 to present. The number of infectious individuals is inferred using the SEIRV model and COVID-19 hospitalizations.

Many Coloradans have already been infected with the Omicron variant. **We estimate that Omicron has infected roughly 42% of the Colorado population to date. By late-February, we estimate that this will**

increase to 65%. This increase of 23% means that a large number of Coloradans may be infected with Omicron in the weeks ahead.

Estimated prevalence and the number of people infected are based on the latest model fit (1/23/2022) and our current, model-based estimates of immune escape and infectiousness of Omicron. These estimates are sensitive to the model assumptions, including assumptions about the probability an infected individual will be symptomatic and require hospital care, which vary by age, and assumptions about the virulence of variants. Estimates of future infections assume we follow the current trajectory, as shown on Figure 2.

Key message 2. We estimate that the numbers of new SARS-CoV-2 infections from the Omicron variant and COVID-19 hospital demand will decline in the weeks ahead.

We estimate that COVID-19 hospital demand and the number of people infected will be much lower by late-February due to high levels of immunity in the population. Infection prevalence should drop below 1% and the daily number of people hospitalized with COVID-19 could be below 500 by the end of February. There is, however, substantial uncertainty with regard to the rate of decline of hospital demand over the course of February. We have used two approaches to estimate the potential rate of decline: 1) simulations using the Colorado model; and 2) examining the trajectories of hospitalizations and cases in other places that are further along in their Omicron epidemics than Colorado.

Simulations using the Colorado COVID-19 Model. We used our model to estimate the potential number of people hospitalized with COVID-19 and the prevalence of infections through the end of February. Projected hospital demand and infection prevalence are based on the latest model fit (1/23/2022) and our current, model-based estimates of immune escape and infectiousness of Omicron. Based on recent model simulations and COVID-19 data, we assume that contact rates have decreased in recent weeks (and, correspondingly, transmission control has increased). To account for uncertainties in the weeks ahead, we include projections accounting for a possible relaxation of transmission control in the next two to six weeks. Our projections do not account for the emergence of a novel variant as we cannot predict the severity or timing of its arrival.

In the model simulations, COVID-19 hospital demand and prevalence drop over the month of February such that hospital demand is well below 500 patients hospitalized with COVID-19 and prevalence is below 1% by the end of February (Figure 2). In the scenarios, relaxation of transmission control (due, for example, to increases in population mixing or a more infectious Omicron subvariant) lead to more cumulative hospitalizations and infections, and in the extreme case, a brief increase in prevalence. In all scenarios, the number of people hospitalized with COVID-19 at the end of February could be at the lowest levels observed in 2021. In all scenarios, infection prevalence is projected to be between 0.5 and 1.0% by the end of February. This estimated prevalence is well below current levels and that of the peaks, but well above estimated infection prevalence in summer 2021.

Our model estimates of rapid decline of infection prevalence and hospital demand are consistent with projections from other modeling groups, including the [COVID Scenario Modeling hub](#) and [The Institute of Health Metrics and Evaluation](#). However, as we note in the next section, it is possible that hospital demand declines more slowly than our model projects.

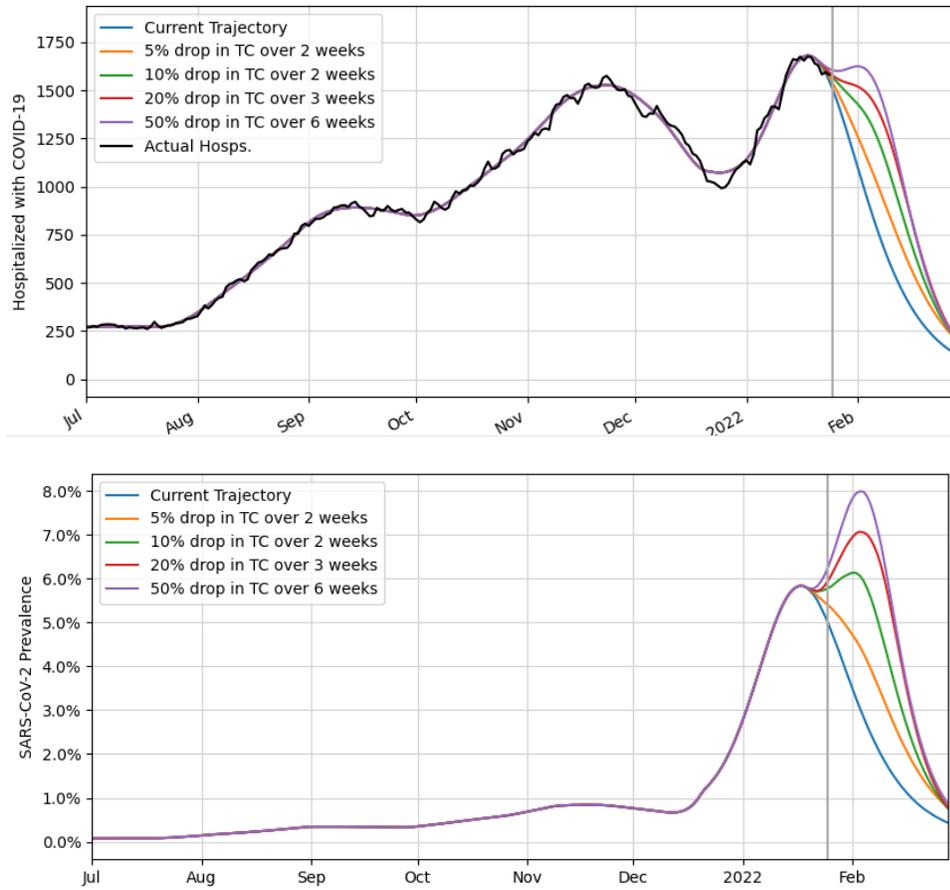


Figure 2. Projected daily COVID-19 hospital demand (top) and infection prevalence (bottom) in Colorado through the end of February. Black line shows actual daily COVID-19 hospital demand through 1/23/2022. To account for uncertainties, projections are generated assuming Colorado remains on the current trajectory (blue line), as well as accounting for possible relaxation in transmission control in the next two to six weeks (orange, green, red and purple lines).

Omicron in other countries and cities. We have been tracking reported SARS-CoV-2 cases and COVID-19 hospitalizations in selected places where the Omicron epidemic began ahead of that in Colorado. These are places with near real-time reporting so that a continually updated comparison can be made to Colorado. For these comparisons, we identify Day 1 for the start of the Omicron wave in each location as the day that Omicron-driven case growth detectably begins (or deviates from the Delta trajectory). For these comparisons, Day 1 of Colorado's Omicron wave is December 18. We then line up the curves for Colorado and the other places based on the timing of Day 1. When lined up this way, Colorado's Omicron wave is four weeks behind Gauteng Province in South Africa; two to three weeks behind Denmark, London, and the rest of South Africa; one week or less behind New York City, the states of New York and New Jersey, and the rest of the United Kingdom, excluding London.

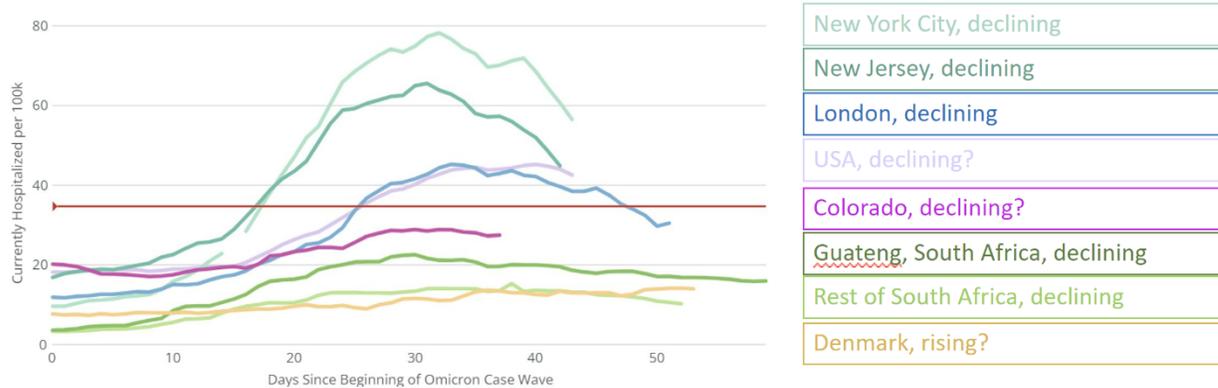


Figure 3. The daily number of patients hospitalized with COVID-19 in Colorado and select locations where the Omicron wave has proceeded Colorado's. Hospital demand is aligned by the day 1 of the Omicron epidemic in each region, which we define as the day that Omicron-driven case growth detectably begins (or, in regions where cases were previously rising, the day that case growth deviates from the Delta trajectory).

In most locations, reported cases levelled off between days 23 to 31 of the Omicron waves and COVID-19 hospitalizations levelled off starting approximately 1 week later, on days 30 to 33 (Figure 3). However, some places are still experiencing growth in hospital demand four or more weeks into their Omicron waves (Florida, day 37; Denmark, day 52).

The pattern of decline in the weeks ahead. The Colorado model and experience in other locations both indicate that COVID-19 hospital demand and SARS-CoV-2 infections will continue to decline over the next 5 weeks with confidence. In Colorado, reported cases began to decline on day 25 and COVID-19 hospitalizations began to decline on day 32. Our analyses suggest that downward trend should continue, however there is uncertainty with regard to the rate of decline in hospital demand. Our model and others project a relatively steep decline across the month of February. If Colorado were to follow the trajectory of COVID-19 hospital demand seen in New York City, the decline would parallel that projected by the model. If the decline in COVID-19 hospital demand in Colorado is comparable to that in London or Gauteng Province, it could take twice as long for our hospitalizations to decline compared to our model simulations. We expect greater certainty over the coming weeks.

Key message 3. Immunity to SARS-CoV-2 is high and rising. We estimate approximately 80% of the Colorado population will be immune by mid-February.

The anticipated rapid decline in SARS-CoV-2 infections and COVID-19 hospital demand is due to the rapid growth of immunity in the Colorado population. Figure 4 displays the percentages of Coloradans immune to Omicron and non-Omicron SARS-CoV-2 strains over time. The figure includes the estimates for immunity due to vaccination alone and for overall immunity combining vaccination and naturally acquired immunity. **We estimate approximately 75% of the population is immune to Omicron infection and that immunity will rise to 80% by mid-February.**

Across 2021, vaccine-associated immunity rose as vaccines became widely available and then waned as infection and vaccine-acquired immunity weakened. Immunity began rising again in fall of 2021 due to a

combination of boosters and infections during the Delta wave. At the start of the Omicron wave in December 2021, immunity against Omicron was under 50% due to gaps in vaccination and booster uptake and Omicron's increased breakthrough potential. In the last six weeks, immunity against Omicron rose rapidly to about 75%, as almost half of the Colorado population was infected with Omicron. This high level of immunity is driving the current decline of the Omicron epidemic in Colorado and leads to anticipation of a relatively low rate of infection in the months leading to the summer.

Our estimates reflect estimated immunity to SARS-CoV-2 infection. While protection against infection has waned with the arrival of new variants, vaccines and boosters confer substantial protection against infection and continue to maintain high protection against severe disease (e.g., [UKHSA Technical Briefing](#), [Leon et al 2022 MMWR](#)). We therefore expect that protection against COVID-19 hospitalization and death is greater than captured by our current immunity assumption.

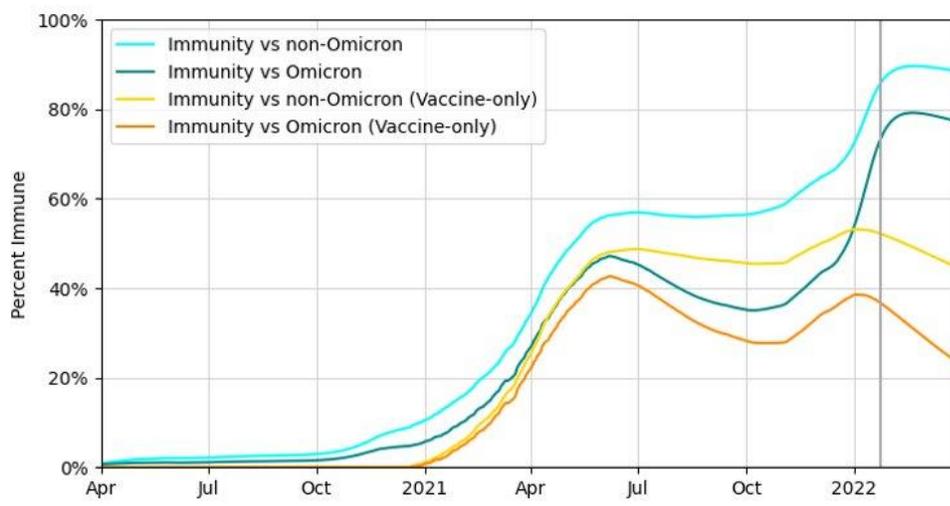


Figure 4. The percent of the Colorado population estimated to be immune to Omicron infection and to prior variants. Blue lines show immunity due to both vaccination and infection. The yellow and orange lines show immunity due to vaccinations alone.

Estimates of immunity were generated using the Colorado COVID-19 model. These estimates reflect the latest scientific evidence that infection-acquired and vaccine-acquired immunity wanes over time. Estimated immunity against Omicron is lower than for prior variants, reflecting the immune escape of the Omicron variant.

Key message 4. Colorado should experience comparatively low rates of COVID-19 across the spring in the absence of a new variant.

Hospitalizations and infections resulting from the Omicron variant will likely decline in Colorado in the weeks ahead, as described above. Due to vaccination and infection, immunity to Omicron is high and rising. By mid-February, approximately 80% of Coloradans will be immune to Omicron. In the months ahead, there is the potential for a lull in the pandemic that could reach into the summer. The prospects for the long-term hinge on maintaining immunity through vaccination and on the characteristics of

future variant strains that may reach Colorado. **These coming months represent a window to prepare for the possibility of yet another COVID-19 wave driven by a variant.**

This picture of a high rate of population immunity has led to suggestions that the COVID-19 pandemic could be ending and that an era is beginning in which COVID-19 is endemic, causing outbreaks but not society-disrupting epidemic waves. For example, in a [commentary in *The Lancet*](#), Chris Murray, who directs the Institute for Health Metrics and Evaluation (IHME) gives away his prediction in its title: “Covid-19 will continue but the end of the pandemic is near.” We agree that a lull lies ahead with the Omicron variant in Colorado but are quite uncertain as to how long it will last.

Vaccinations. Over the next few months, Colorado is likely to continue to have sporadic outbreaks of SARS-CoV-2, particularly among the unvaccinated who remain at risk for infection, hospitalization, and death. Data on vaccination in Colorado indicate that 29% of the total population is unvaccinated and that 28% of those who are booster eligible have not yet received a third dose. Looking across the state, there is a wide range in vaccination uptake (Figure 5). There is considerable evidence that booster doses provide robust protection against severe disease due to Omicron infection (e.g., [UKHSA Technical Briefing 31](#)). Efforts to increase the uptake of primary vaccinations in the not-yet vaccinated and boosters among those eligible will provide protection against severe disease during the remainder of the Omicron wave and is likely to reduce severe disease and strain on hospitals during the next wave.

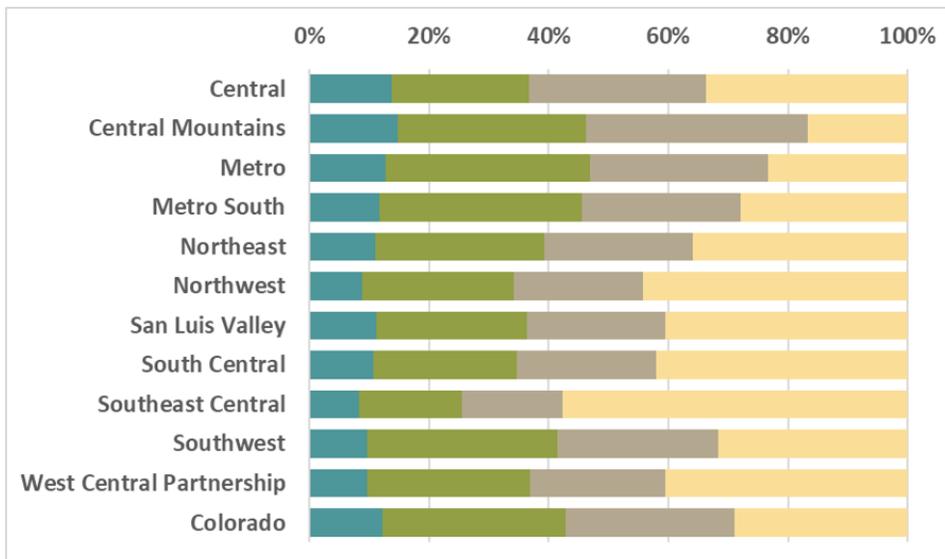


Figure 5. Vaccination status by region. Percent of the total population that is vaccinated and not yet booster eligible (teal), boosted (green), booster eligible (grey) and unvaccinated (yellow).

Variants. New variants have been the main cause of COVID surges. We do not know when the next variant will emerge or what characteristics it will have. Consequently, it is impossible to anticipate the course of the pandemic beyond the next several months and consequently the projections in this report do not capture the consequences of a new variant. A Delta resurgence between now and summer is unlikely, as early evidence suggests that having been infected with Omicron reduces susceptibility to Delta.

Issues we are watching. Our understanding of SARS-CoV-2 is changing rapidly, and there are several key uncertainties that we will be watching in the months ahead. First, the possibility of an influenza pandemic remains although influenza cases have been limited to date. Influenza transmission may have been limited by the personal and governmental measures taken to limit the transmission of SARS-CoV-2. Early data suggest flu vaccination uptake has been lower nationwide in 2021-22 compared to last year (CDC). Second, there remains uncertainty regarding the duration of immunity due to vaccines with and without boosters and due to having been infected with SARS-CoV-2. It is clear that immunity due to prior infection and vaccination declines over time; however, protection against severe disease is more durable. It is not yet clear whether additional vaccine doses will be recommended in the future. Third, we do not yet fully understand the long-term health effects of COVID-19. Long COVID is thought to impact a subset of those infected. As the majority of Coloradans will likely have been infected by the end of the Omicron surge, there is a need to understand the coming disease burden from the syndrome of Long COVID. This is a topic that we will be addressing.

Conclusions

In summary, for the short-term extending to the end of March, we anticipate a continued decline of the Omicron wave. Absent another variant that is highly transmissible and not well covered by the current profile of immunity, the lull in the pandemic could reach into the summer. These coming months represent a window to prepare for the possibility of yet another COVID-19 wave driven by a variant. Increasing access to testing, particularly rapid testing, will be of benefit. There is also an effort by the Federal and state government to enhance access to more effective N95 and KN95 respirators which can slow the spread of infections and increase preparedness for dealing with a new variant. The data on vaccination confirm the need to increase the rate of vaccination in Colorado, addressing both the unvaccinated and those who are eligible but have not received a third dose.

Appendix

The model is an age-structured SEIRV (susceptible-exposed-infected-recovered-vaccinated) infectious disease transmission model that has been calibrated to Colorado-specific data whenever possible. For example, the length of time that a COVID-19 patient is assumed to spend in the hospital varies by age and over time and is based on data provided by Colorado hospitals. Model details and a listing of recent model updates are provided in the Appendix at the end of this report.

This report is based on hospitalization data through 1/23/2022 and vaccination data through 1/14/2022. In our model simulations, we estimate that Omicron is more infectious and has greater immune escape than Delta. We also estimate that Omicron is less severe, reducing both the probability of infection and the length of hospital stay among those hospitalized with COVID-19.

Code is available on Github at <https://github.com/CSPH-COVID/covid-models>.