

COVID-19 Results Briefing

United States of America

December 15, 2022

This document contains summary information on the latest projections from the IHME model on COVID-19 in the United States of America. The model was run on December 15, 2022, with data through December 12, 2022.

The US is experiencing an increase in infections, reported cases, hospitalizations, and deaths due to the BA.5 variant and winter seasonality. The increase in reported deaths so far has been small. In our reference scenario, we expect infections will peak in mid-December and then decline slowly but remain above 1 million a day until April. A rapid return to high levels of mask use (80%) could impede transmission and reduce infections, cases, and deaths over the next 4 months. The reduction in deaths could amount to more than 20,000 lives saved.

Our reference scenario suggests a mild winter in comparison to previous winters with COVID-19. Two critical issues drive the future impact of COVID-19. First, waning vaccine-derived and infection-acquired immunity is enough, particularly for infection, that BA.5 can continue to circulate at a high level in the US. Ongoing Omicron infection acts to maintain high levels of immunity in the population, especially as uptake of boosters remains low. This level of ongoing infection means that for a variant to replace the Omicron subvariants requires a considerable degree of immune escape. Our reference scenario does not include the possibility of a new variant with sufficient immune escape and increased severity.

Individuals and state governments need to track the likely levels of immunity in the population. As more and more individuals had their last vaccination many months ago, the fraction of the population that is susceptible will rise. While Omicron on average is one-tenth as severe as the Delta variant, the challenge will be if population levels of immunity drop to a low level at a time when a new, more severe variant with immune escape emerges. While the most likely outcome is relatively low levels of hospitalization and death due to COVID-19, health services and public health authorities need to monitor for the emergence anywhere in the globe of a new variant with immune escape and increased severity and act accordingly.

Current situation

- Estimated daily infections in the last week increased to 1,677,000 per day on average compared to 1,547,000 the week before (Figure 1.1).
- Daily reported cases in the last week increased to 72,000 per day on average compared to 59,000 the week before (Figure 2.1).
- Daily hospital census in the last week (through December 12) increased to 39,000 per day on average compared to 35,000 the week before.
- Reported deaths due to COVID-19 in the last week increased to 390 per day on average compared to 340 the week before (Figure 3.1).

- Total deaths due to COVID-19 in the last week increased to 490 per day on average compared to 420 the week before (Figure 3.1). This makes COVID-19 the number five cause of death in the US this week (Table 1). Estimated total daily deaths due to COVID-19 in the past week were 1.3 times larger than the reported number of deaths.
- The daily rate of reported deaths due to COVID-19 is greater than 4 per million in one state, Maine (Figure 4.1).
- The daily rate of total deaths due to COVID-19 is greater than 4 per million in two states (Figure 4.2).
- We estimate that 98% of people in the US have been infected at least once as of December 12 (Figure 6.1).
- Effective R, computed using cases, hospitalizations, and deaths, is greater than 1 in 41 states and the District of Columbia (Figure 7.1).
- The infection-detection rate in the US was close to 6% on December 12 (Figure 8.1).
- Based on the GISAID and various national databases, combined with our variant spread model, we estimate the current prevalence of variants of concern (Figures 9.1-9.6). The BA.5 Omicron subvariant remains the dominant source of infection.

Trends in drivers of transmission

- Based on self-reported mask use data collected in the COVID-19 Trends and Impact Survey, an estimated 8% of people are projected to always wear a mask when leaving their home. Mask use after June 24, 2022, is a statistical forecast.
- As of December 12, 36 states and the District of Columbia have reached 70% or more of the population who have received at least one vaccine dose, and 24 states and the District of Columbia have reached 70% or more of the population who are fully vaccinated (Figures 12.1 and 12.2). 82% of people in the US have received at least one vaccine dose, and 71% are fully vaccinated.
- In our current reference scenario, we expect that 267.3 million people will be vaccinated with at least one dose by April 1 (Figure 14.1). We expect that 74% of the population will be fully vaccinated by April 1.

Projections and scenarios

We produce three scenarios when projecting COVID-19. The **reference scenario** is our forecast of what we think is most likely to happen:

- Vaccines are distributed at the expected pace. Brand- and variant-specific vaccine efficacy is updated using the latest available information from peer-reviewed publications and other reports.
- Future mask use will decline to 50% of the minimum level it reached between January 1, 2021, and May 1, 2022. This decline begins after the last observed data point in each location and transitions linearly to the minimum over a period of six weeks.

- Mobility increases as vaccine coverage increases.
- Mandates will be reimposed at the maximum level of mandates in the post-ancestral period once the death rate has reached an algorithmic minimum threshold of daily reported deaths for a given location.
- 80% of those who are fully vaccinated (two doses for most vaccines, or one dose for Johnson & Johnson) receive an additional dose six months after becoming fully vaccinated, and 80% of those who receive an additional dose receive a second additional dose six months later.
- Antiviral utilization for COVID-19 risk prevention has reached 80% in high-risk populations and 50% in low-risk populations between March 1, 2022, and June 1, 2022. This applies in high-income countries, but not low- and middle-income countries, and this rollout assumption follows a similar pattern to global vaccine rollouts.

The **80% mask use scenario** makes all the same assumptions as the reference scenario but assumes all locations reach 80% mask use within seven days. If a location currently has higher than 80% use, mask use remains at the current level.

The **antiviral access scenario** makes all the same assumptions as the reference scenario but assumes globally distributed antivirals and extends coverage to all low- and middle-income countries between August 15, 2022, and September 15, 2022.

Infections

- Daily estimated infections in the **reference scenario** peak at 1.7 million in mid-December (Figure 16.1).
- Daily estimated infections in the **80% mask use scenario** will decline to 467,070 by mid-February and then increase (Figure 16.1).
- Daily estimated infections in the **antiviral access scenario** peak at 1.7 million in mid-December (Figure 16.1).

Cases

- Daily estimated cases in the **reference scenario** will rise to 100,880 by January 1, 2023 (Figure 16.2).
- Daily estimated cases in the **80% mask use scenario** will rise to 86,530 by December 21, 2022 (Figure 16.2).
- Daily estimated cases in the **antiviral access scenario** will rise to 100,880 by January 1, 2023 (Figure 16.2).

Hospitalizations

- Daily hospital census in the **reference scenario** will rise to 53,610 by January 2, 2023 (Figure 16.3). At some point from December through April 1, four states will have high or extreme stress on hospital beds (Figure 18.1). At some point from December through April 1, one state will have high or extreme stress on intensive care unit (ICU) capacity (Figure 19.1).

- Daily hospital census in the **80% mask use scenario** will rise to 46,220 by December 23, 2022 (Figure 16.3).
- Daily hospital census in the **antiviral access scenario** will rise to 53,610 by January 2, 2023 (Figure 16.3).

Deaths

- In our **reference scenario**, our model projects 1,136,000 cumulative reported deaths due to COVID-19 on April 1. This represents 56,000 additional deaths from December 12 to April 1. Daily reported COVID-19 deaths in the **reference scenario** will rise to 650 by January 11, 2023 (Figure 16.4).
- Under our **reference scenario**, our model projects 1,447,000 cumulative total deaths due to COVID-19 on April 1. This represents 72,000 additional deaths from December 12 to April 1 (Figure 16.5).
- In our **80% mask use scenario**, our model projects 1,115,000 cumulative reported deaths due to COVID-19 on April 1. This represents 35,000 additional deaths from December 12 to April 1. Daily reported COVID-19 deaths in the **80% mask use scenario** will rise to 590 by January 2, 2023 (Figure 16.4).
- In our **antiviral access scenario**, our model projects 1,136,000 cumulative reported deaths due to COVID-19 on April 1. This represents 56,000 additional deaths from December 12 to April 1. Daily reported COVID-19 deaths in the **antiviral access scenario** will rise to 650 by January 11, 2023 (Figure 16.4).
- Figure 17.1 compares our reference scenario forecasts to other publicly archived models. Forecasts are widely divergent.

Model updates

We have updated our reference scenario to assume that mandates will be re-imposed at the maximum level of mandates in the post-ancestral period once the death rate has reached an algorithmic minimum threshold of daily reported deaths for a given location.

For the foreseeable future, we will not be updating our model or producing COVID-19 estimates. These will be the final briefing documents we produce until further notice.

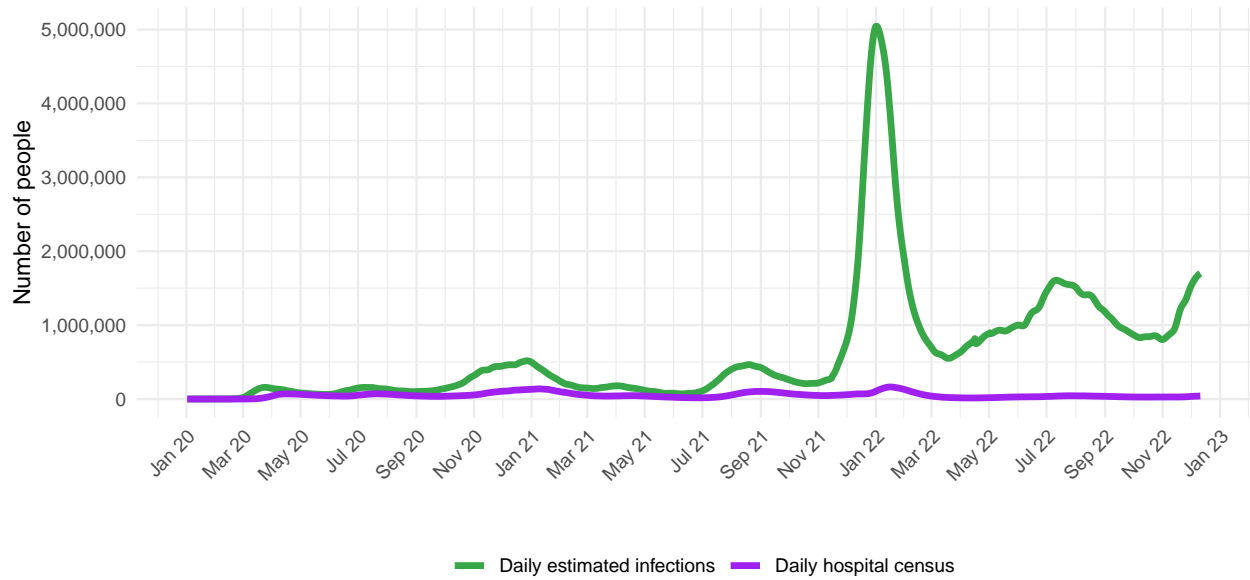
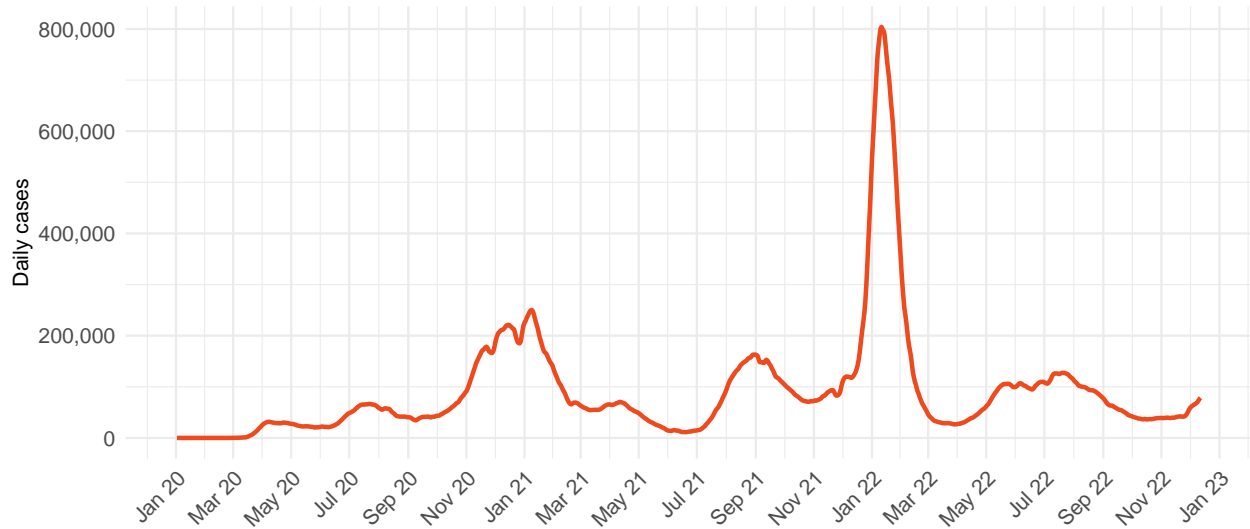
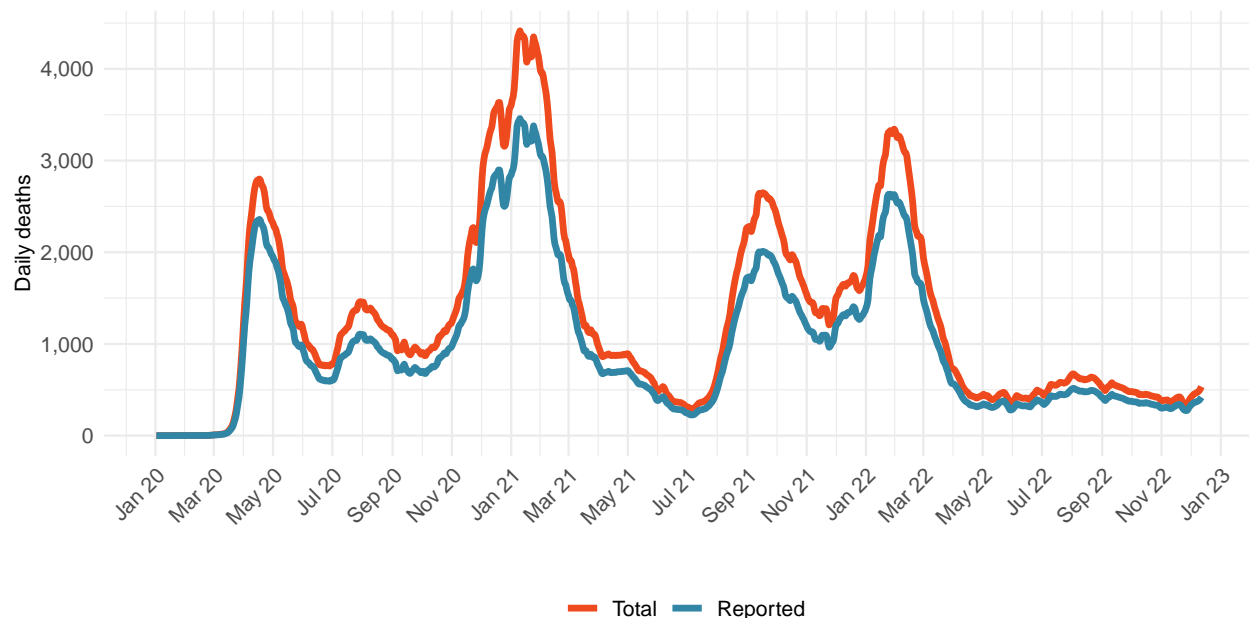
Figure 1.1: Daily COVID-19 hospital census and estimated infections

Figure 2.1: Reported daily COVID-19 cases, moving average


Table 1: Ranking of total deaths due to COVID-19 among the leading causes of mortality this week, assuming uniform deaths of non-COVID causes throughout the year

Cause name	Weekly deaths	Ranking
Ischemic heart disease	10,724	1
Tracheal, bronchus, and lung cancer	3,965	2
Chronic obstructive pulmonary disease	3,766	3
Stroke	3,643	4
COVID-19	3,426	5
Alzheimer's disease and other dementias	2,768	6
Chronic kidney disease	2,057	7
Colon and rectum cancer	1,616	8
Lower respiratory infections	1,575	9
Diabetes mellitus	1,495	10

Figure 3.1: Smoothed trend estimate of daily COVID-19 deaths



Daily COVID-19 death rate per 1 million on December 12, 2022

Figure 4.1: Daily reported COVID-19 death rate per 1 million

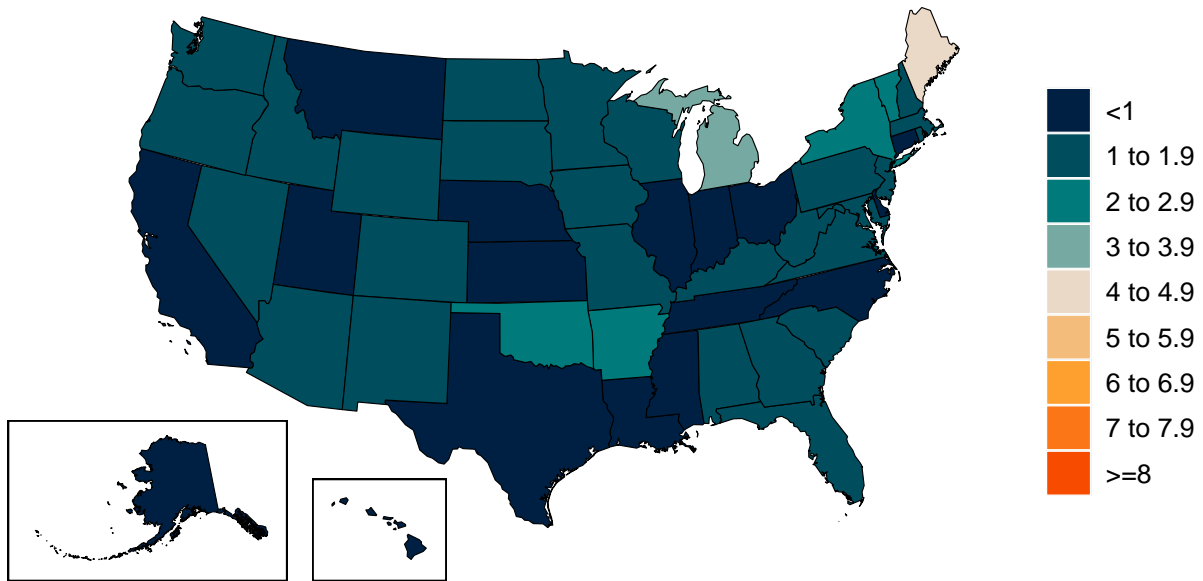


Figure 4.2: Daily total COVID-19 death rate per 1 million

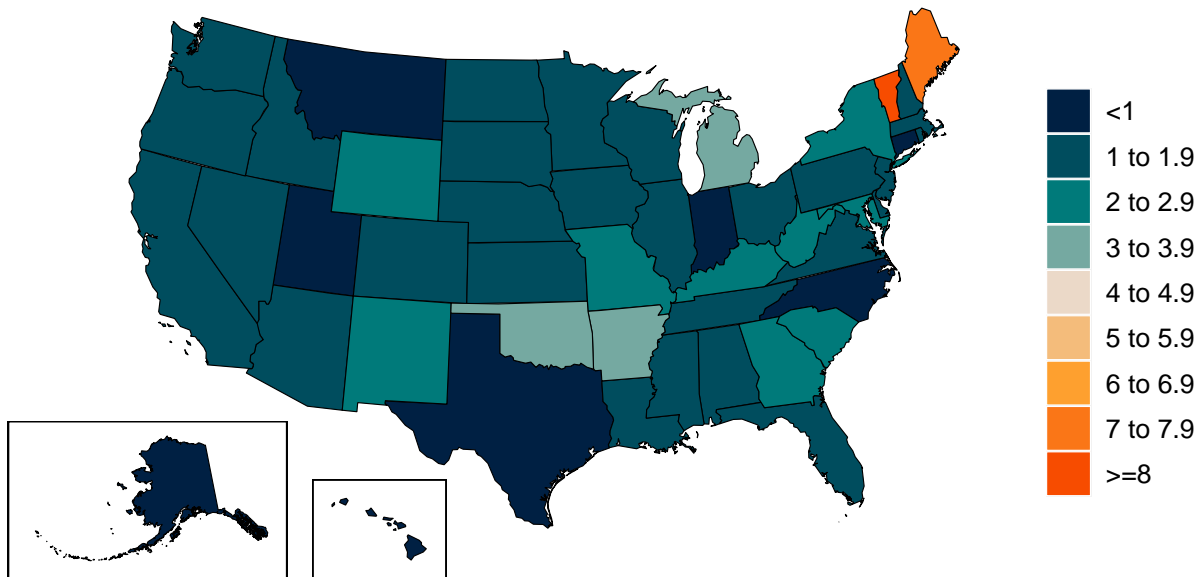


Figure 6.1: Estimated percent of the population infected with COVID-19 on December 12, 2022

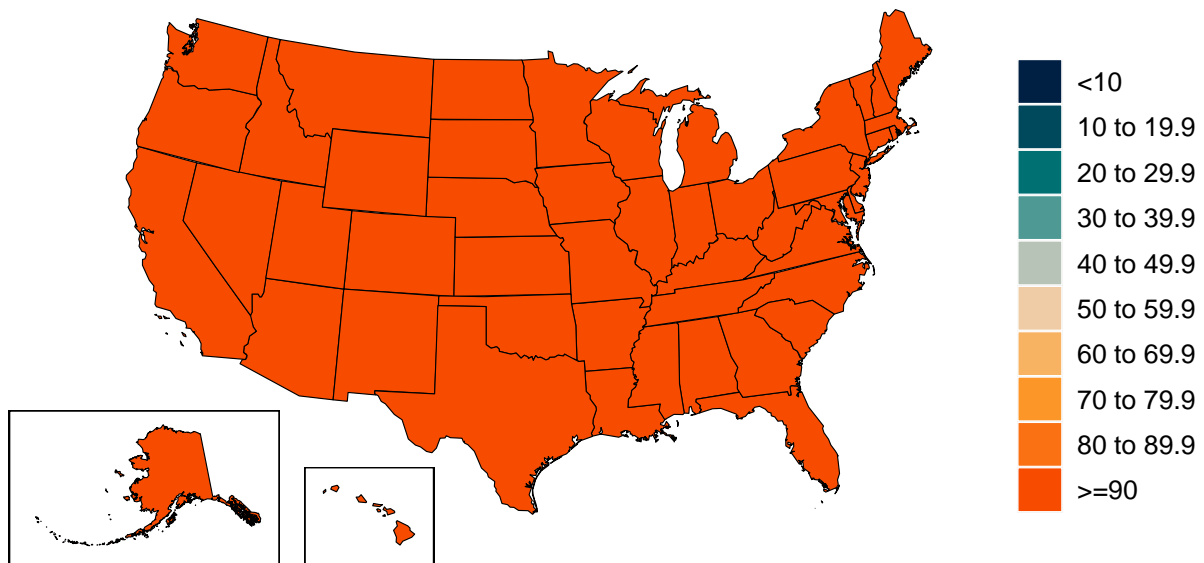


Figure 7.1: Mean effective R on December 1, 2022. Effective R less than 1 means that transmission should decline, all other things being held the same. The estimate of effective R is based on the combined analysis of deaths, case reporting, and hospitalizations where available. Current reported cases reflect infections 11-13 days prior, so estimates of effective R can only be made for the recent past.

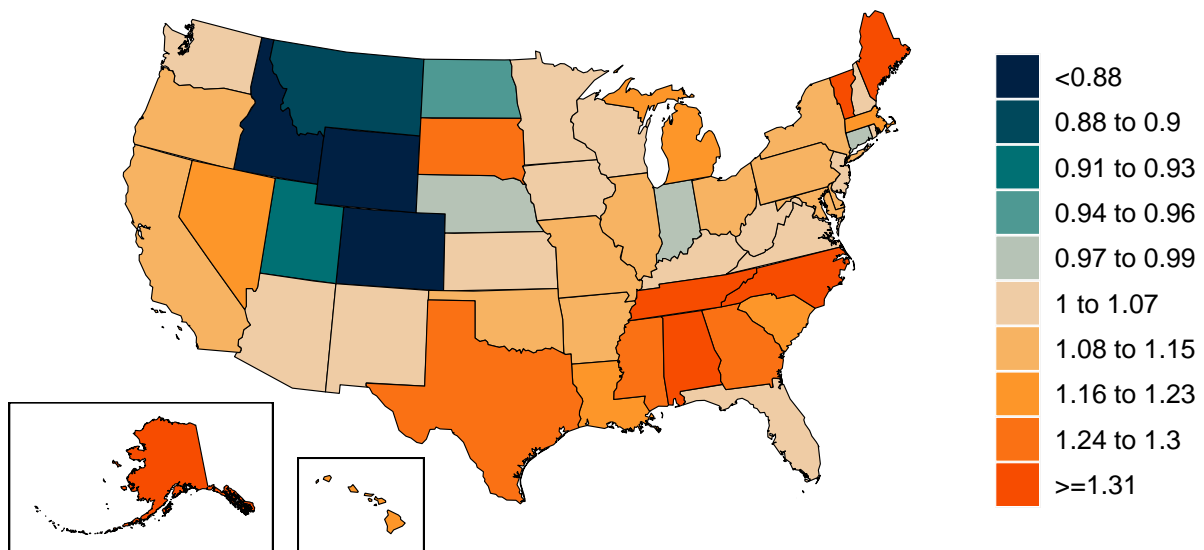
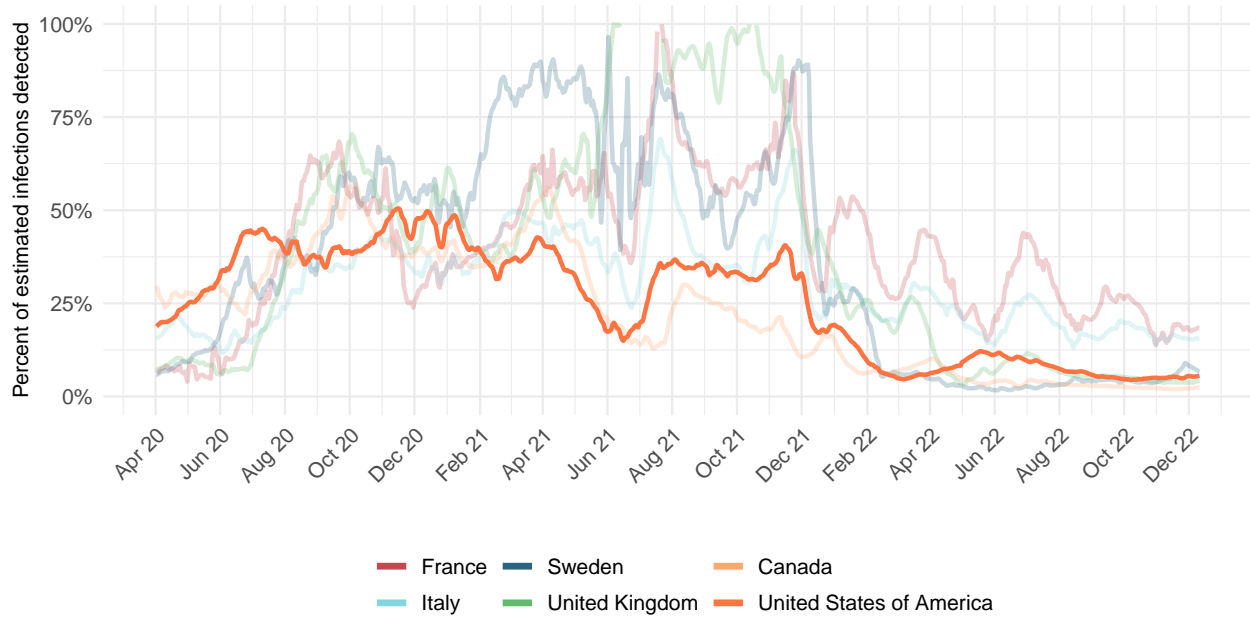


Figure 8.1: Percent of estimated COVID-19 infections detected. This is estimated as the ratio of reported daily COVID-19 cases to estimated daily COVID-19 infections based on the SEIR disease transmission model. Due to measurement errors in cases and testing rates, the infection-detection rate can exceed 100% at particular points in time.



Estimated percent of circulating SARS-CoV-2 for primary variant families on December 12, 2022

Figure 9.1: Estimated percent of new infections that are Alpha variant

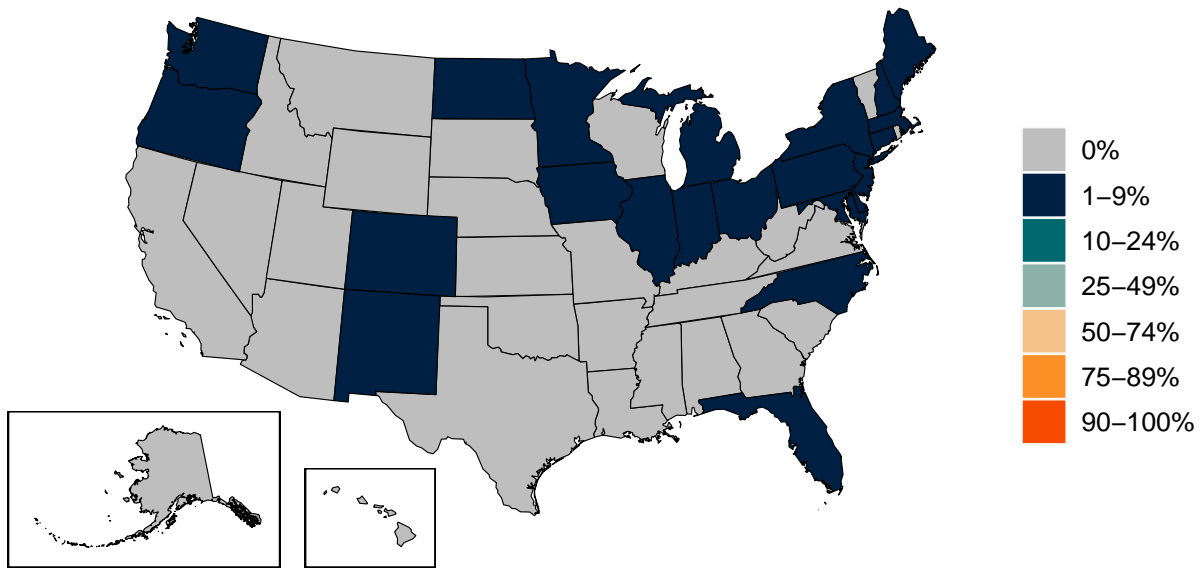


Figure 9.2: Estimated percent of new infections that are Beta variant

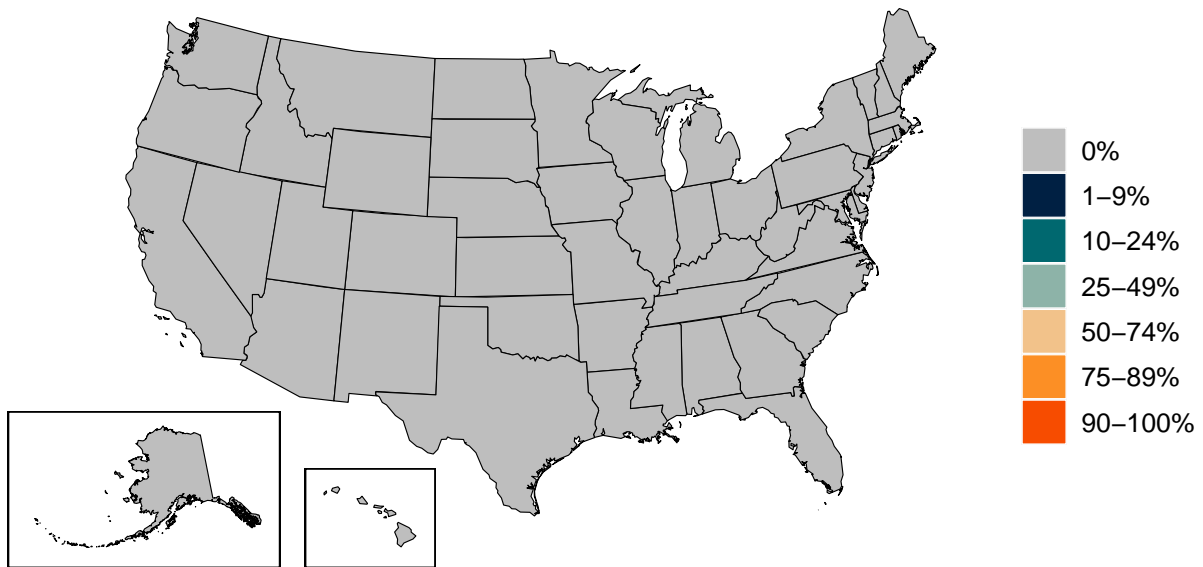


Figure 9.3: Estimated percent of new infections that are Delta variant

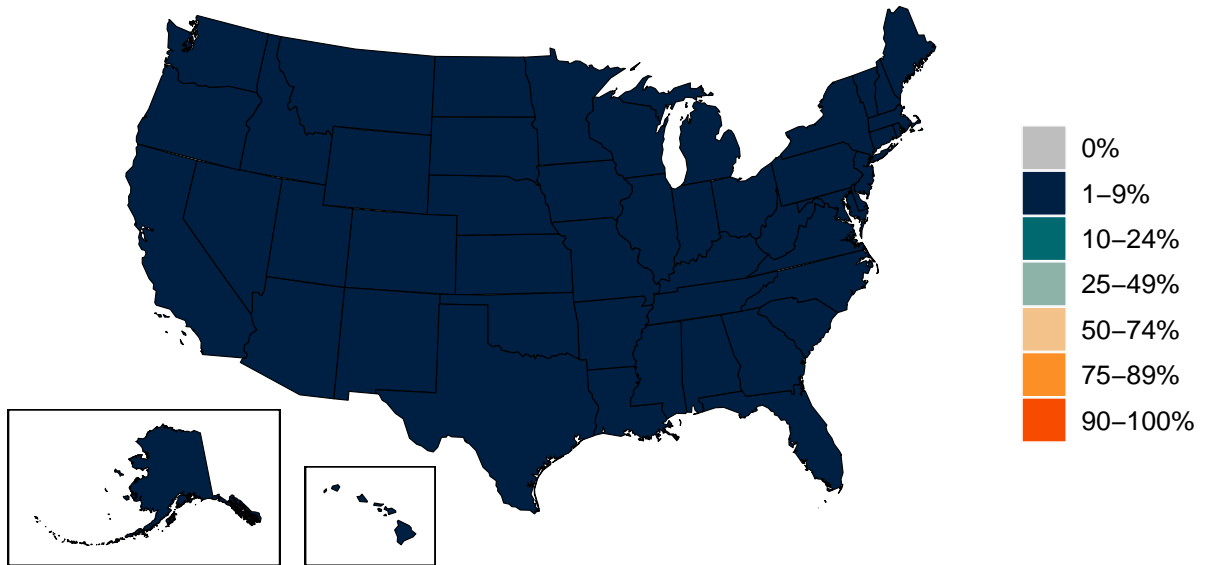


Figure 9.4: Estimated percent of new infections that are Gamma variant

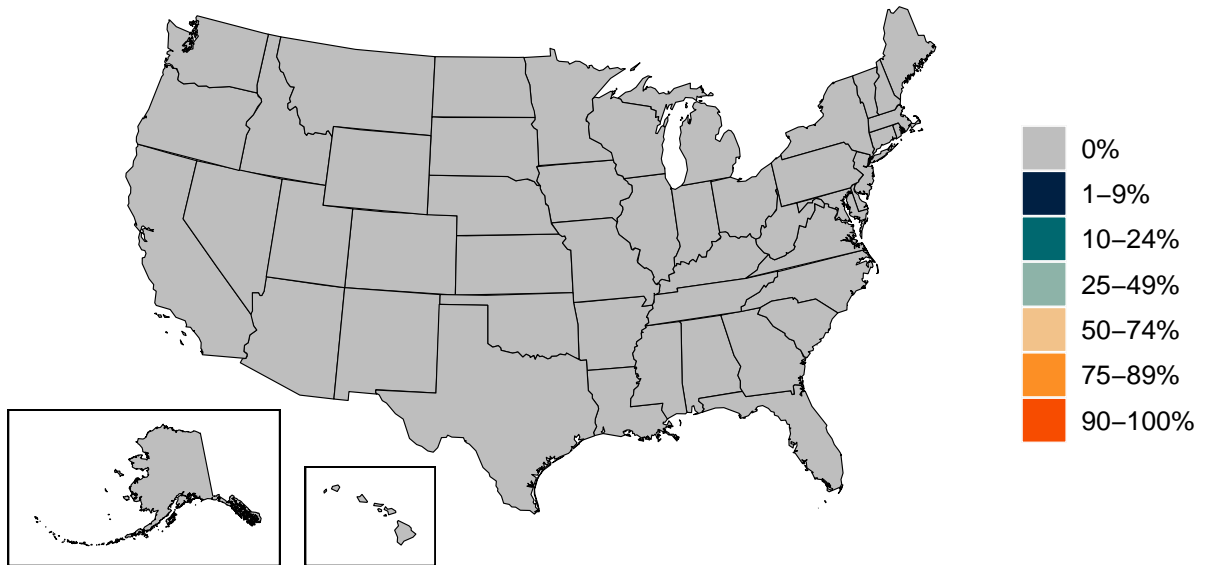


Figure 9.5: Estimated percent of new infections that are BA.1/BA.2 variant

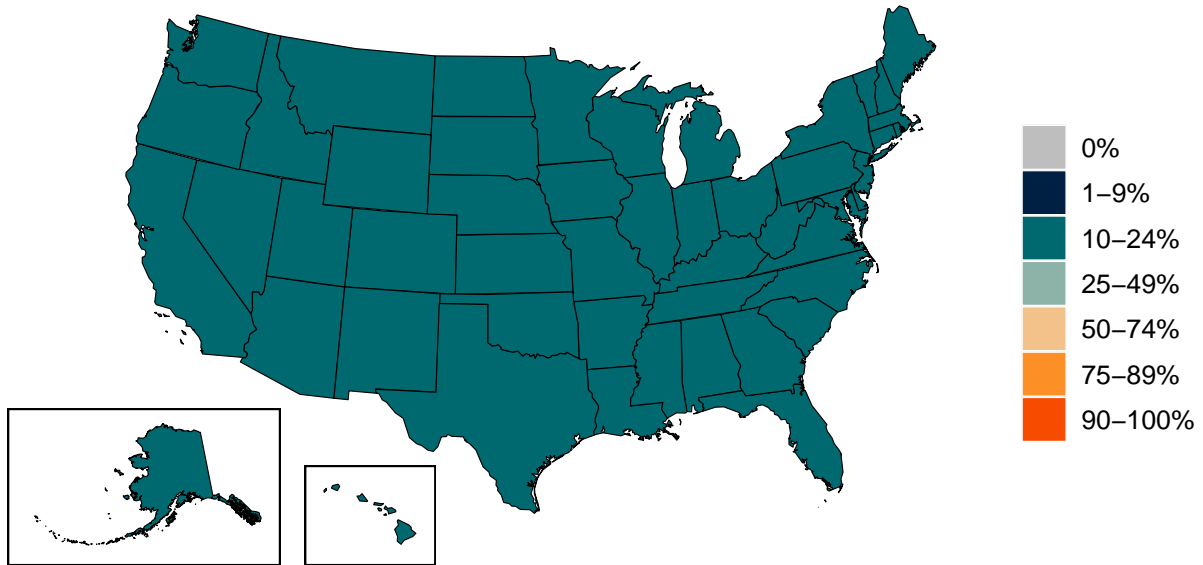


Figure 9.6: Estimated percent of new infections that are BA.5 variant

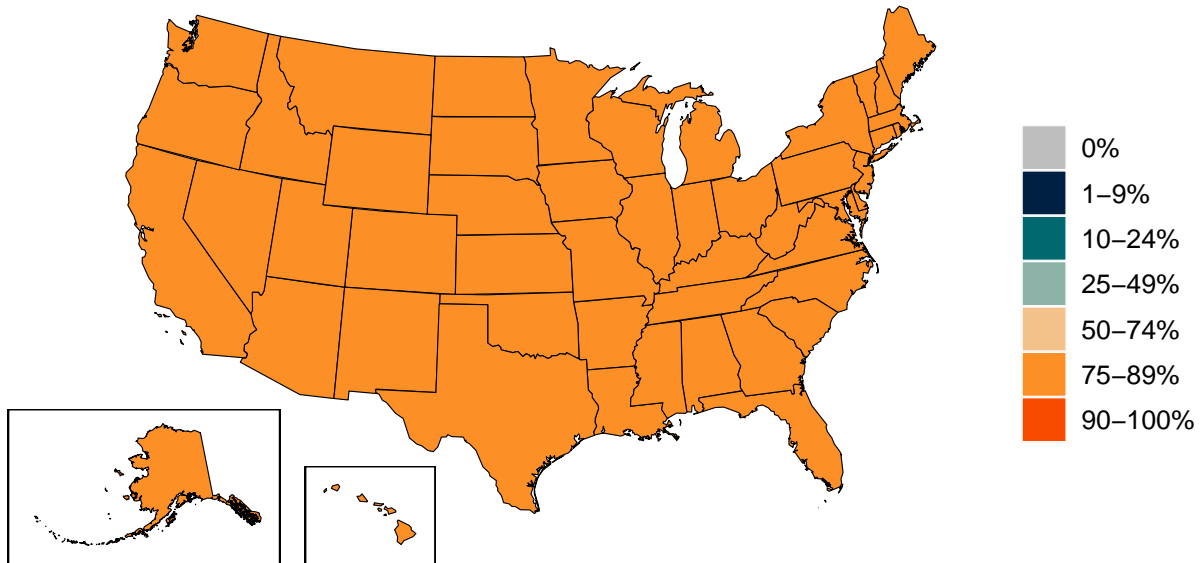
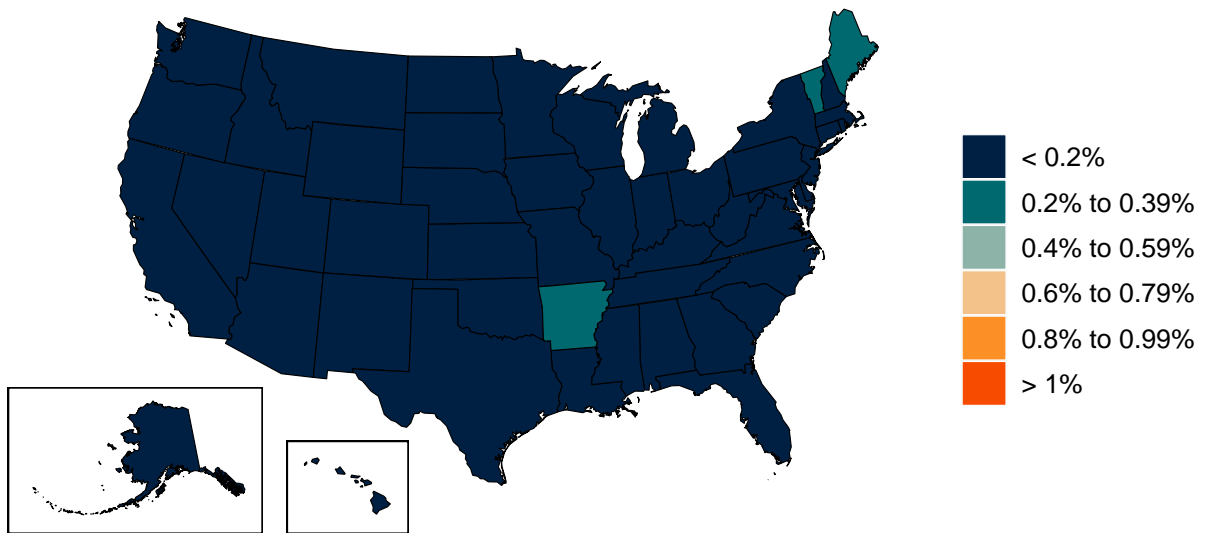


Figure 10.1: Infection-fatality rate on December 12, 2022. This is estimated as the ratio of COVID-19 deaths to estimated daily COVID-19 infections.



Critical drivers

Table 2: Current mandate implementation

	Primary school closure	Secondary school closure	Higher school closure	Entry restrictions for some non-residents	Entry restrictions for all non-residents	Individual movements restricted	Curfew for businesses	Individual curfew	Gathering limit: 6 indoor, 10 outdoor	Gathering limit: 10 indoor, 25 outdoor	Gathering limit: 25 indoor, 50 outdoor	Gathering limit: 50 indoor, 100 outdoor	Gathering limit: 100 indoor, 250 outdoor	Restaurants closed	Bars closed	Restaurants / bars closed	Restaurants / bars curbside only	Gyms, pools, other leisure closed	Non-essential retail closed	Non-essential retail curbside only	Non-essential workplaces closed	Stay home order	Stay home fine	Mask mandate	Mask mandate fine
Alabama																									
Alaska																									
Arizona																									
Arkansas																									
California																									
Colorado																									
Connecticut																									
Delaware																									
District of Columbia																									
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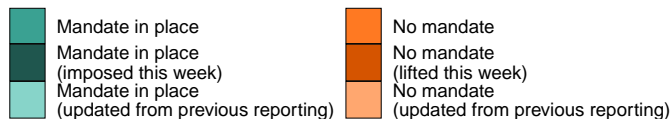


Figure 11.1: Trend in the proportion of the population reporting always wearing a mask when leaving home

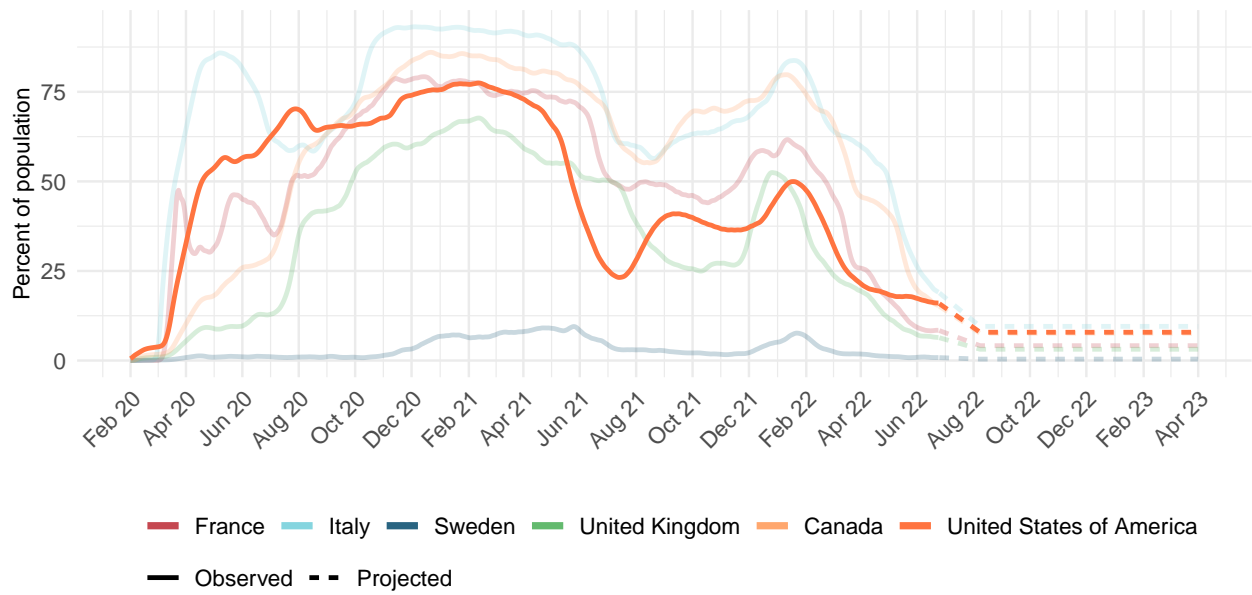


Table 3: Estimates of vaccine effectiveness for specific vaccines used in the model at preventing severe disease and infection. We use data from clinical trials directly, where available, and make estimates otherwise. More information can be found on our [website](#).

Vaccine	Effectiveness at preventing													
	Ancestral		Alpha		Beta		Gamma		Delta		BA.1/BA.2		BA.5	
	Severe disease	Infection	Severe disease	Infection	Severe disease	Infection	Severe disease	Infection	Severe disease	Infection	Severe disease	Infection	Severe disease	Infection
AstraZeneca	94%	63%	94%	63%	94%	69%	94%	69%	94%	69%	71%	36%	71%	36%
CanSino	66%	62%	66%	62%	64%	61%	64%	61%	64%	61%	48%	32%	48%	32%
CoronaVac	50%	47%	50%	47%	49%	46%	49%	46%	49%	46%	37%	24%	37%	24%
Covaxin	78%	73%	78%	73%	76%	72%	76%	72%	76%	72%	57%	38%	57%	38%
Johnson & Johnson	86%	72%	86%	72%	76%	64%	76%	64%	76%	64%	57%	33%	57%	33%
Moderna	97%	92%	97%	92%	97%	91%	97%	91%	97%	91%	73%	48%	73%	48%
Novavax	89%	83%	89%	83%	86%	82%	86%	82%	86%	82%	65%	43%	65%	43%
Pfizer/BioNTech	95%	86%	95%	86%	95%	84%	95%	84%	95%	84%	72%	44%	72%	44%
Sinopharm	73%	68%	73%	68%	71%	67%	71%	67%	71%	67%	53%	35%	53%	35%
Sputnik-V	92%	86%	92%	86%	89%	85%	89%	85%	89%	85%	67%	44%	67%	44%
Other vaccines	75%	70%	75%	70%	73%	69%	73%	69%	73%	69%	55%	36%	55%	36%
Other vaccines (mRNA)	91%	86%	91%	86%	88%	85%	88%	85%	88%	85%	67%	45%	67%	45%

Percent of the population having received at least one dose (12.1) and fully vaccinated against SARS-CoV-2 (12.2) by December 12, 2022

Figure 12.1: Percent of the population having received one dose of a COVID-19 vaccine

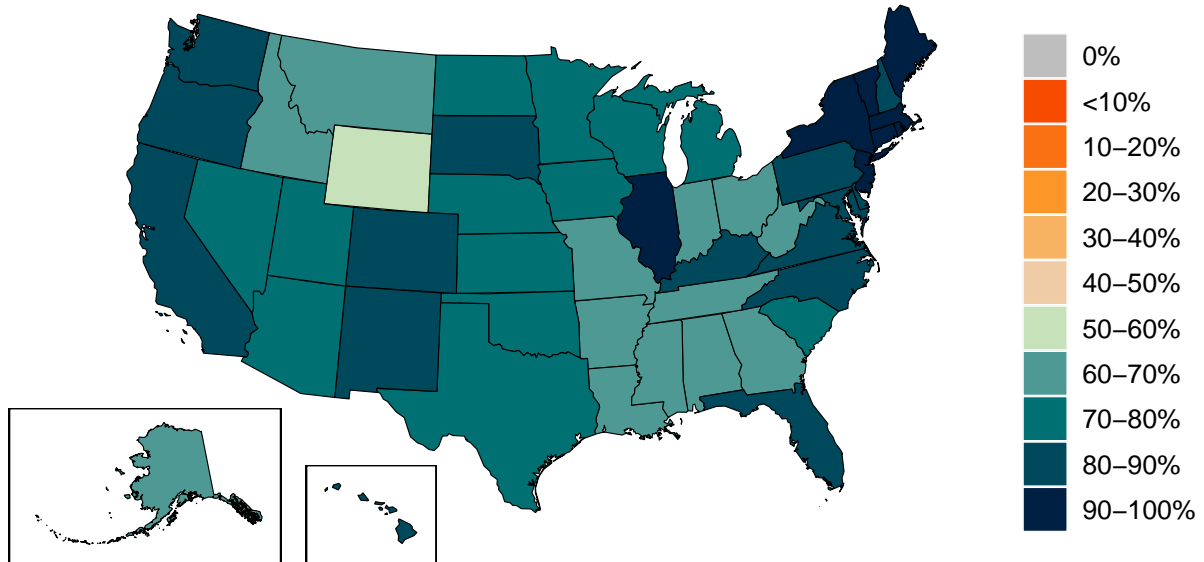


Figure 12.2: Percent of the population fully vaccinated against SARS-CoV-2

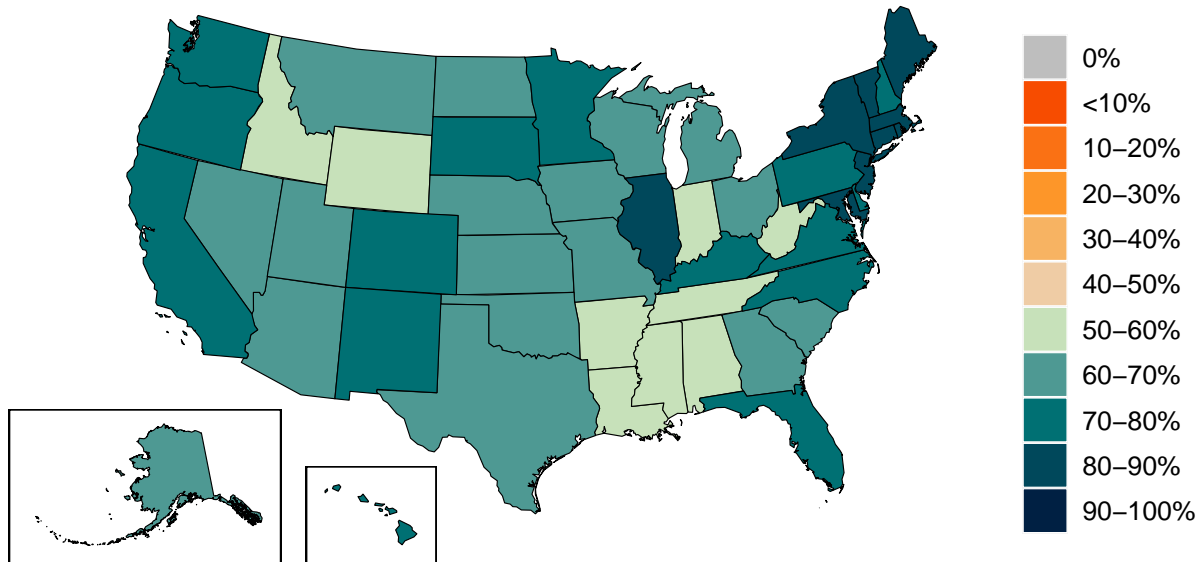


Figure 13.1: Estimated proportion of the total population that is not vaccinated but willing to be vaccinated as of June 24, 2022

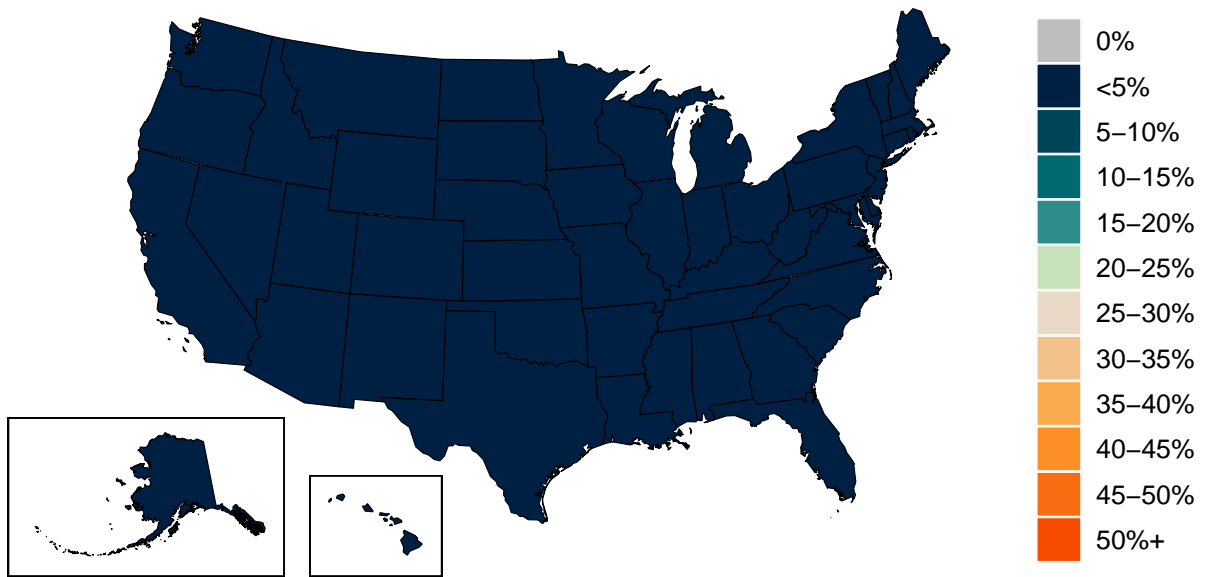


Figure 14.1: Percent of people who receive at least one dose of a COVID-19 vaccine and those who are fully vaccinated

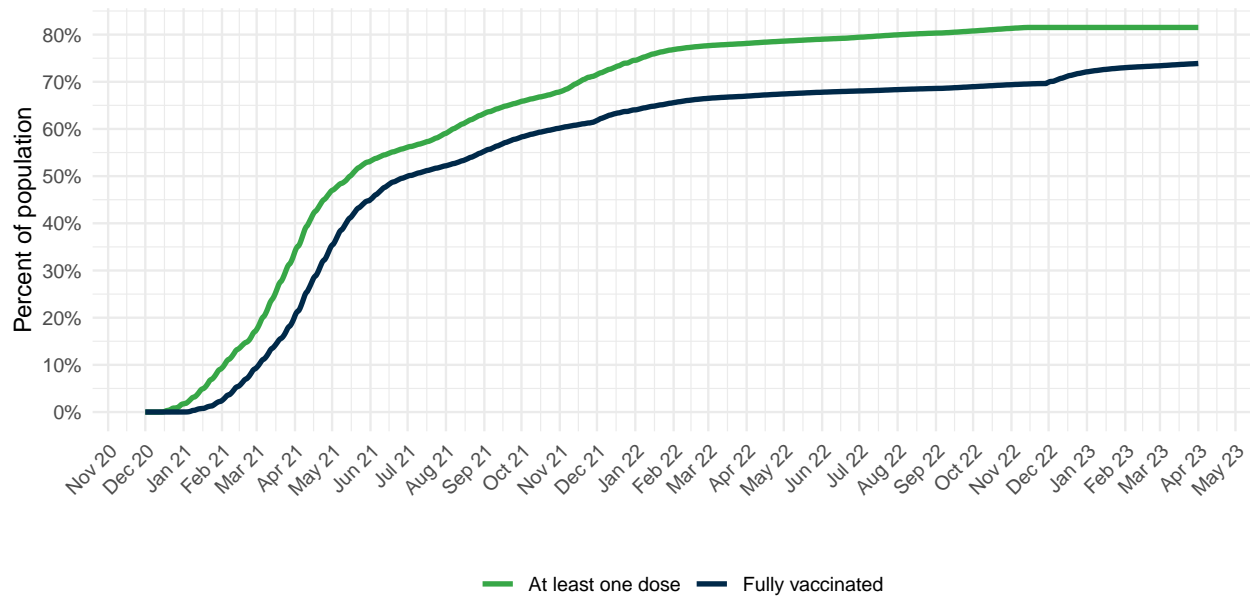
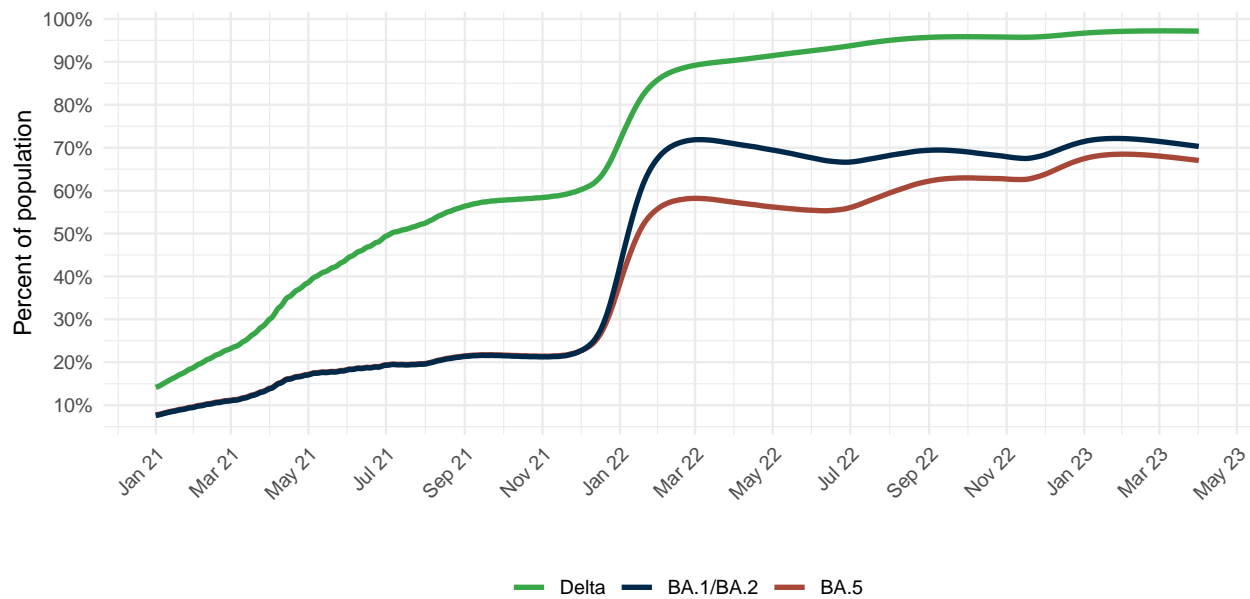


Figure 15.1: Percent of people who are immune to Delta, BA.1/BA.2 or BA.5. Immunity is based on protection due to prior vaccination and infection(s). Moreover, variant-specific immunity is also based on variant-variant specific protection.



Projections and scenarios

Figure 16.1: Daily COVID-19 infections until April 01, 2023 for three scenarios

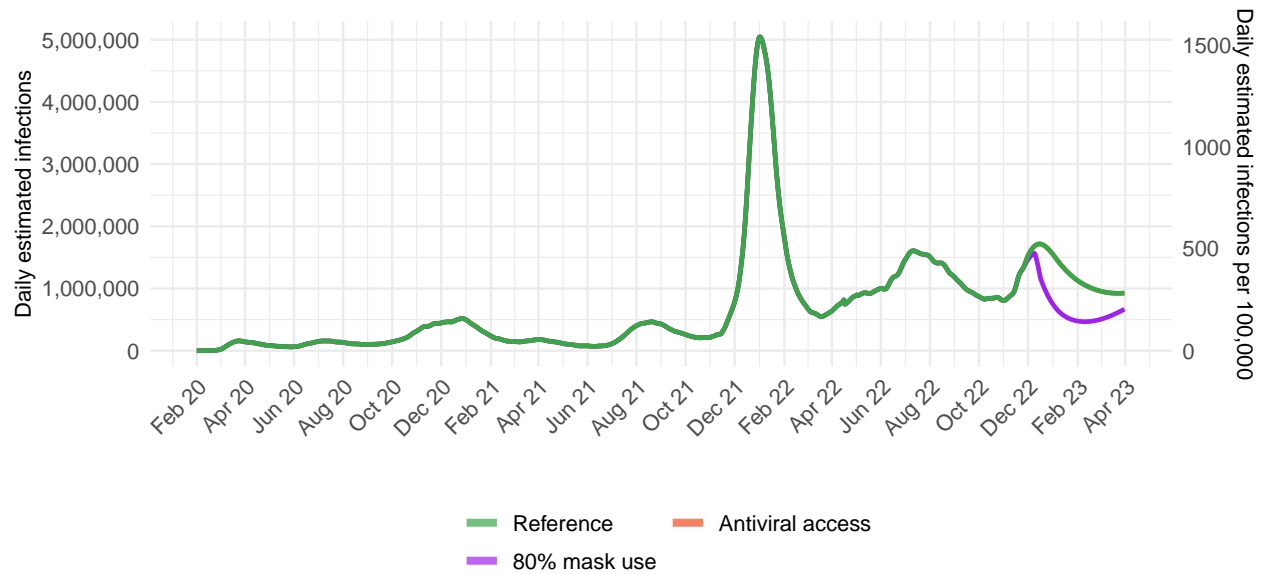


Figure 16.2: Daily COVID-19 reported cases until April 01, 2023 for three scenarios

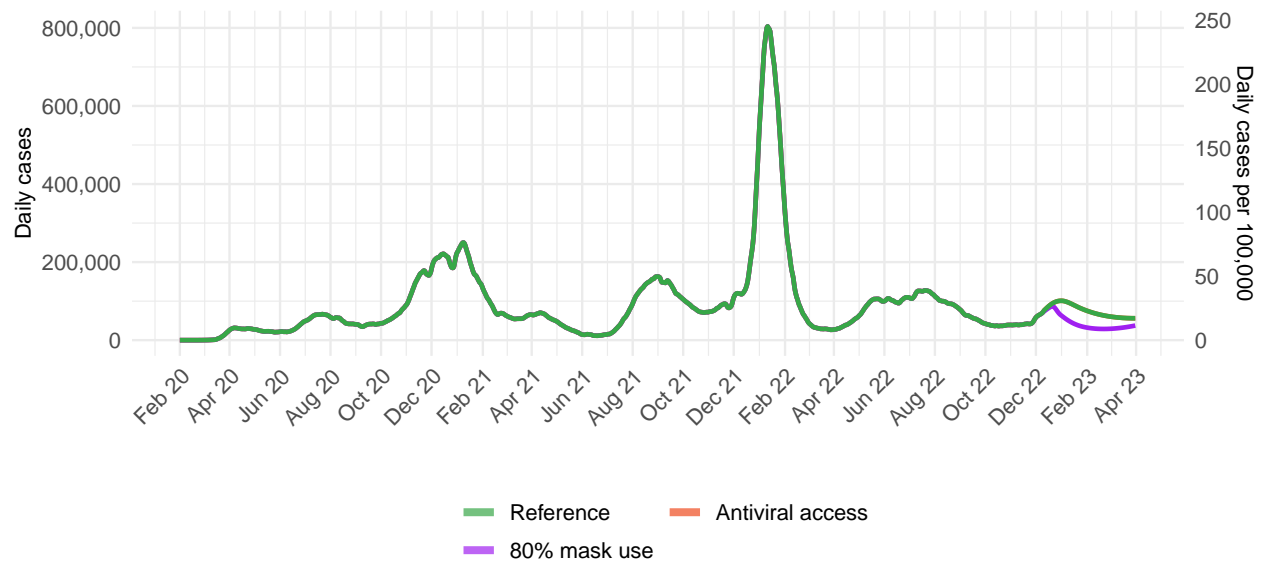


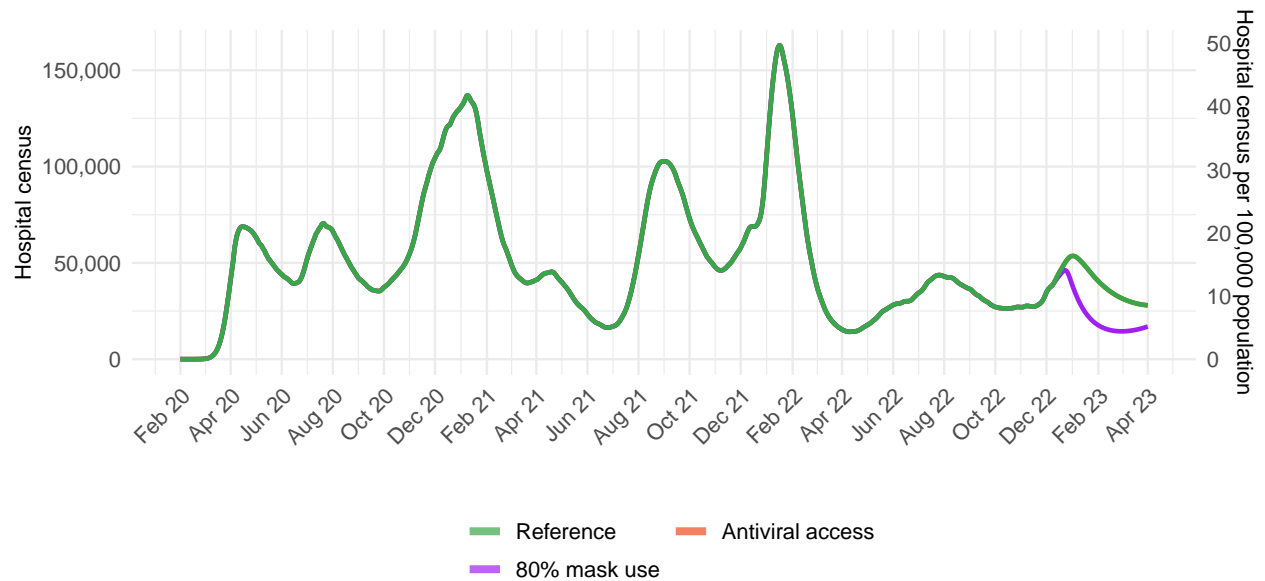
Figure 16.3: Daily COVID-19 hospital census until April 01, 2023 for three scenarios

Figure 16.4: Reported daily COVID-19 deaths per 100,000

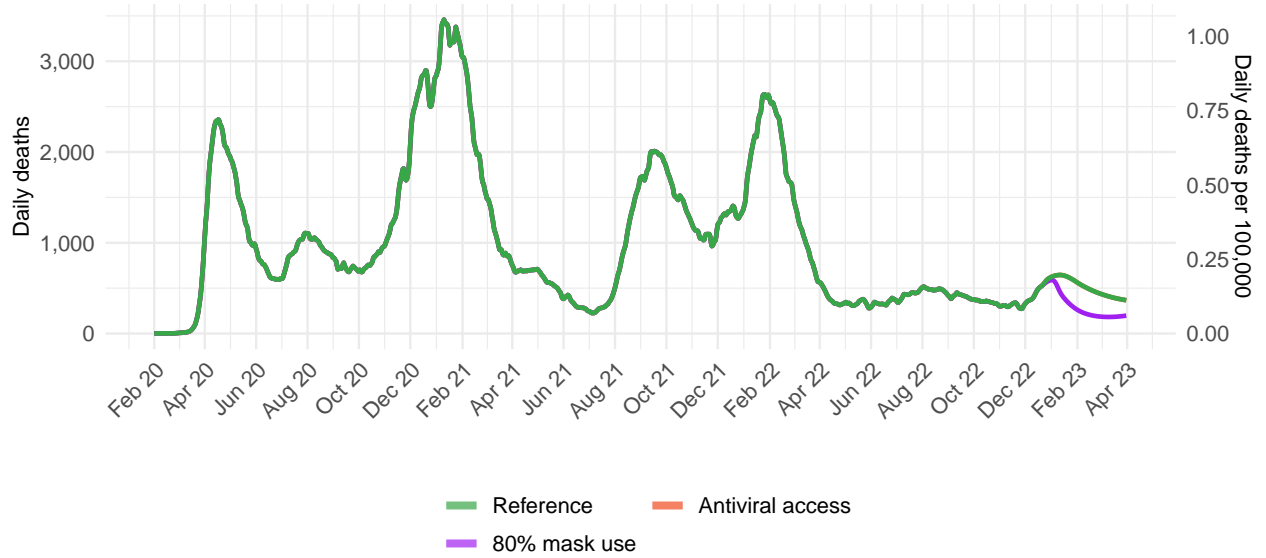


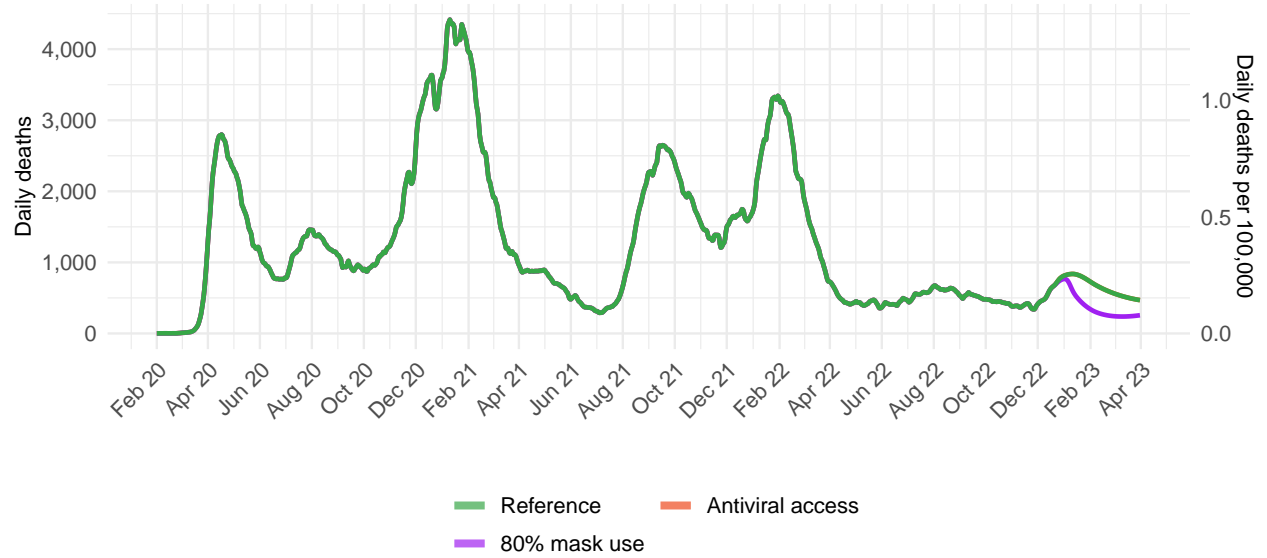
Figure 16.5: Total daily COVID-19 deaths per 100,000

Figure 17.1: Comparison of reference model projections with other COVID modeling groups. For this comparison, we are including projections of daily COVID-19 deaths from other modeling groups when available, last model update in brackets: the SI-KJalpha model from the University of Southern California ([SIKJalpha](#)) [December 5, 2022], and the CDC Ensemble Model ([CDC](#)) [December 12, 2022]. Regional values are aggregates from available locations in that region.

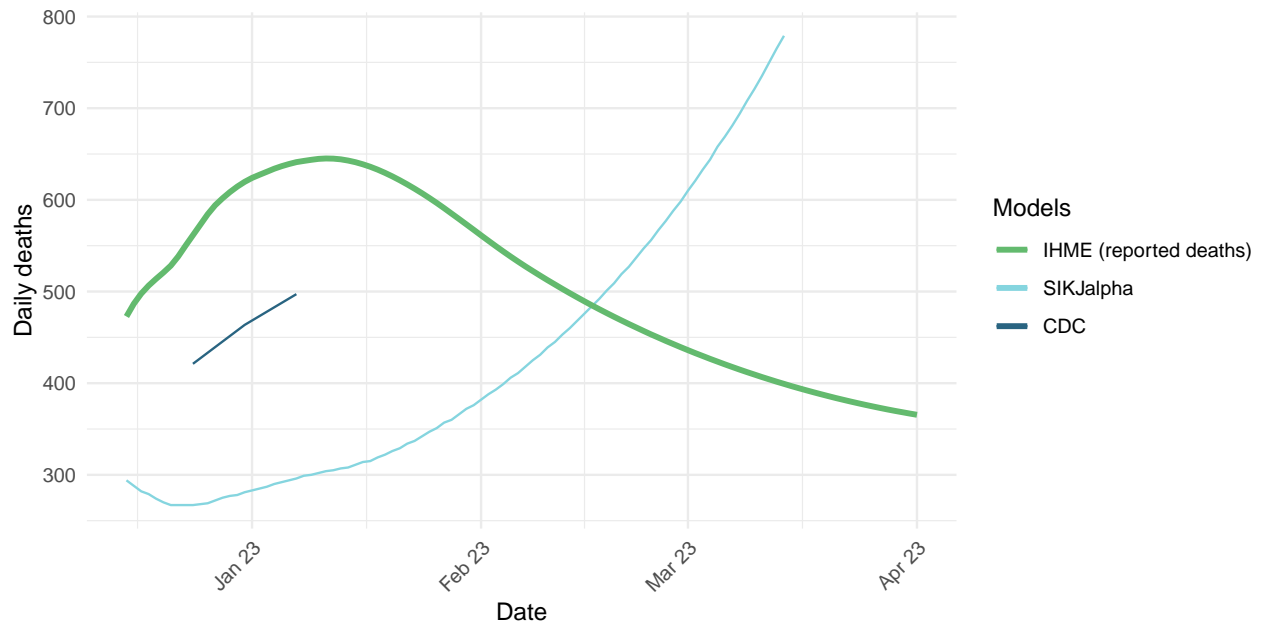


Figure 18.1: The estimated inpatient hospital usage is shown over time. The percent of hospital beds occupied by COVID-19 patients is color-coded based on observed quantiles of the maximum proportion of beds occupied by COVID-19 patients. Less than 5% is considered *low stress*, 5-9% is considered *moderate stress*, 10-19% is considered *high stress*, and 20% or greater is considered *extreme stress*.

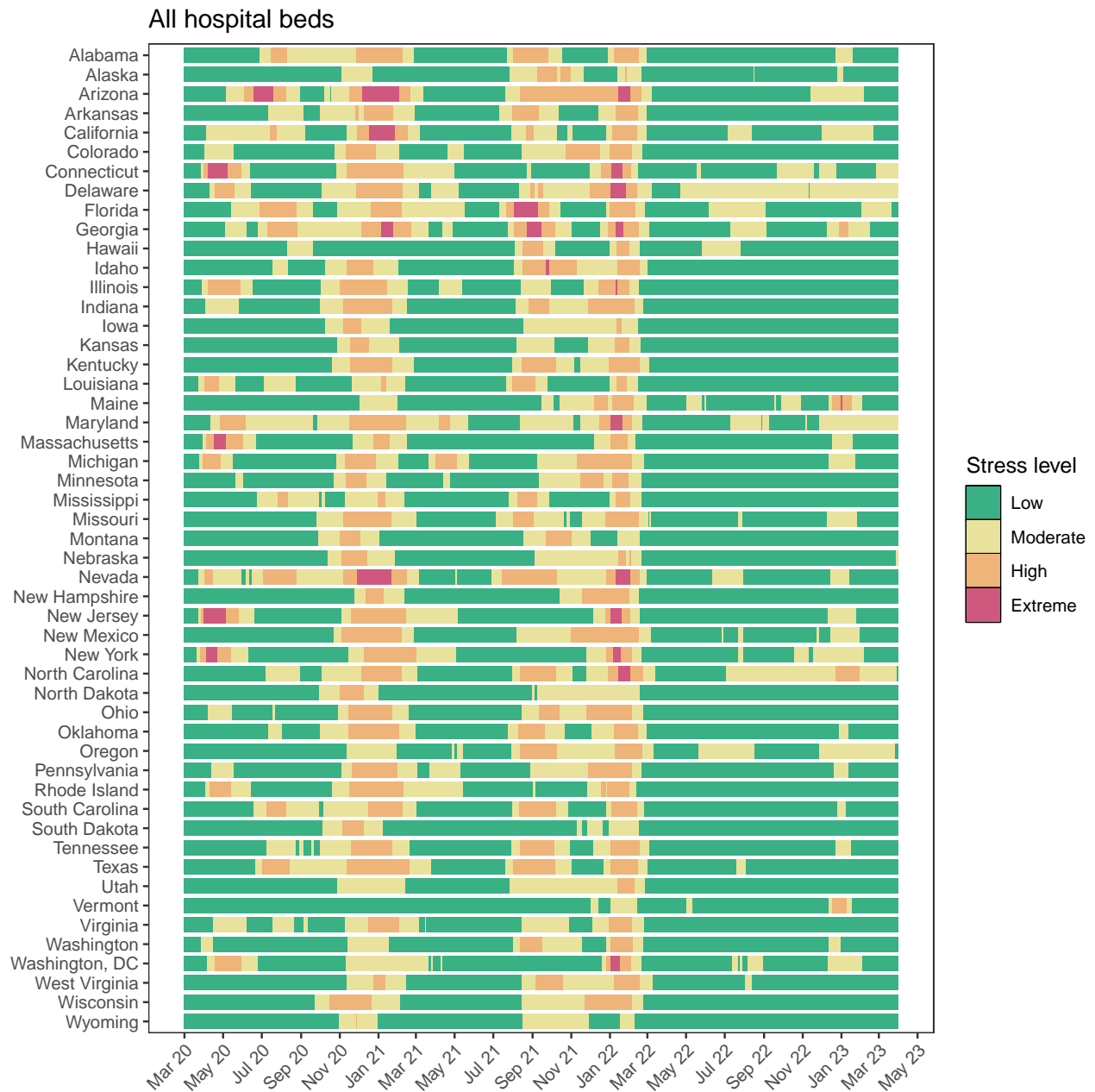
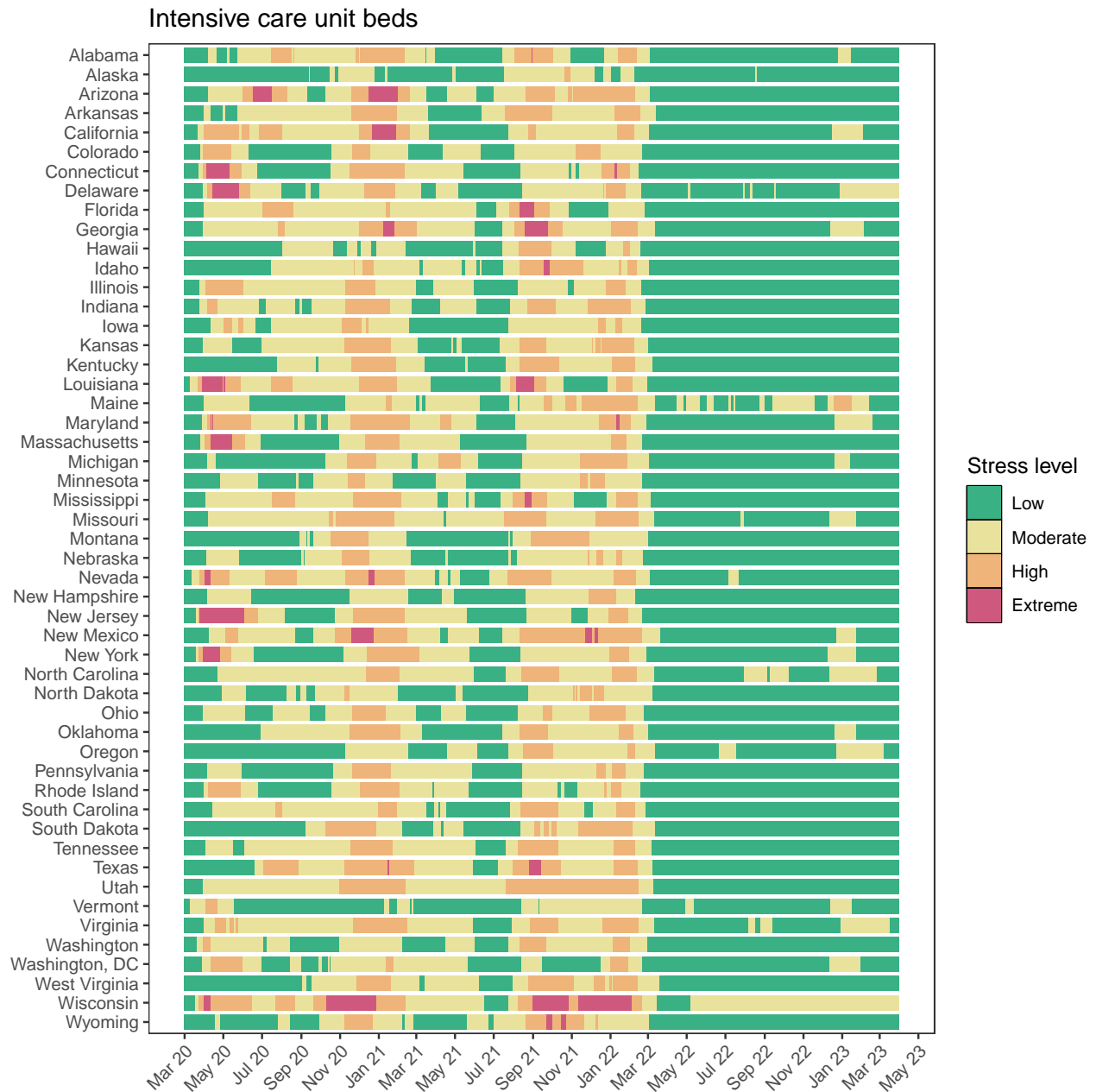


Figure 19.1: The estimated intensive care unit (ICU) usage is shown over time. The percent of ICU beds occupied by COVID-19 patients is color-coded based on observed quantiles of the maximum proportion of ICU beds occupied by COVID-19 patients. Less than 10% is considered *low stress*, 10-29% is considered *moderate stress*, 30-59% is considered *high stress*, and 60% or greater is considered *extreme stress*.



More information

Data sources:

Mask use and vaccine confidence data are from the [The Delphi Group at Carnegie Mellon University and University of Maryland COVID-19 Trends and Impact Surveys](#), in partnership with Facebook. Mask use data are also from [Premise](#), the Kaiser Family Foundation, and the [YouGov COVID-19 Behaviour Tracker](#) survey.

Genetic sequence and metadata are primarily from the GISAID Initiative. Further details available on the COVID-19 model [FAQ page](#).

A note of thanks:

We wish to warmly acknowledge the support of [these](#) and others who have made our COVID-19 estimation efforts possible.

More information:

For all COVID-19 resources at IHME, visit <http://www.healthdata.org/covid>.

To download our most recent results, visit our [Data downloads page](#).

Questions? Requests? Feedback? Please contact us at <https://www.healthdata.org/covid/contact-us>.