

COVID-19 Results Briefing

The United States of America

September 22, 2021

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 September 21, 2021, with data through September 20, 2021.

The Delta surge overall appears to have peaked; infections likely peaked in late August and reported cases and hospitalizations in early September. Given prior lags between cases, hospitalizations, and deaths, we expect deaths should peak in the coming week. The overall pattern masks that many Southern states are farther past their peaks of Delta. Ongoing surges are concentrated in the Midwest and some Atlantic states. Vaccination rates are continuing to increase and may reach levels limited by vaccine hesitancy by early November. Likewise, the fraction of the population with prior natural infection, currently 32%, will also increase in the coming months. These two forces increase effective immunity against the Delta variant, which could potentially reach 65% by the end of the year. Despite the rising levels of immunity, we expect seasonality will increase transmission enough to stop the declines in transmission by the end of October, leading to modest increases in November and December. The late fall and winter increases in reported cases and deaths will be much smaller in proportionate terms than last winter, even if the level of infections may be 75% of last winter's level. Our forecasts of even modest increases in hospitalization rates after an early fall decline combined with likely flu transmission this winter suggests stress on hospitals may be substantial and more than expected. Our forecasts may be optimistic for two critical reasons. First, we have not yet incorporated into our models waning immunity against infection, for which there is strong evidence. Nor have we incorporated waning immunity of vaccination and natural infection against hospitalization and death, for which the evidence is more limited. Second, we do not take into account the potential risk of a new variant with substantial immune escape emerging somewhere in the world with ongoing high levels of transmission that will eventually reach the US. As boosters are delivered in the US to the population at risk or over 65, we will incorporate this into our forecasts. As our mask use scenario demonstrates, a critical factor in the magnitude of hospitalization and death in the US will be the extent to which the current mask use level of 41% is sustained or even increased. Individual behavioral responses in aggregate will substantially affect the trajectory of the pandemic in the coming months.

Current situation

- Estimated daily infections in the last week decreased to 285,300 per day on average compared to 300,800 the week before (Figure 1).
- Daily hospital census in the last week (through September 20) decreased to 96,800 per day on average compared to 101,600 the week before.
- Daily reported cases in the last week stayed relatively constant at 146,200 per day on average compared to 144,100 the week before (Figure 2).

- Reported deaths due to COVID-19 in the last week increased to 1,800 per day on average compared to 1,600 the week before (Figure 3).
- Excess deaths due to COVID-19 in the last week increased to 3,000 per day on average compared to 2,600 the week before (Figure 3). This makes COVID-19 the number 1 cause of death in the United States of America this week (Table 1). Estimated excess daily deaths due to COVID-19 in the past week were 1.6 times larger than the reported number of deaths.
- The daily reported COVID-19 death rate is greater than 4 per million in 24 states (Figure 4).
- The daily rate of excess deaths due to COVID-19 is greater than 4 per million in 31 states (Figure 4).
- We estimate that 32% of people in the US have been infected as of September 20 (Figure 6).
- Effective R, computed using cases, hospitalizations, and deaths, is greater than 1 in 21 states (Figure 7).
- The infection-detection rate in the US was close to 47% on September 20 (Figure 8).
- Based on the GISAID and various national databases, combined with our variant spread model, we estimate the current prevalence of variants of concern (Figure 9). The Delta variant is dominant in all states.

Trends in drivers of transmission

- Only eight states have mask mandates, and five states have some form of gathering restriction. Some mandates have been implemented at the county or city level, not reflected in Table 2.
- Mobility last week was 10% lower than the pre-COVID-19 baseline (Figure 11). Mobility was near baseline (within 10%) in 36 states. Mobility was lowest in California, Arizona, Texas, Louisiana, and Florida.
- As of September 20, in the COVID-19 Trends and Impact Survey, 41% of people self-report that they always wore a mask when leaving their home (Figure 13).
- There were 447 diagnostic tests per 100,000 people on September 20 (Figure 15).
- As of September 20, 10 states have reached 70% or more of the population who have received at least one vaccine dose and no states have reached 70% or more of the population who are fully vaccinated (Figure 17). Fully vaccinated rates are less than 50% in 19 states.
- In the US, 69.9% of adults say they would accept or would probably accept a vaccine for COVID-19. The proportion of the population who are open to receiving a COVID-19 vaccine ranges from 50% in West Virginia to 84% in Massachusetts (Figure 19).

- In our current reference scenario, we expect that 208 million people will be vaccinated with at least one dose by January 1 (Figure 20). We expect that 60% of the population will be fully vaccinated by January 1.
- Based on the estimate of the population that have been infected with COVID-19 and vaccinated to date, combined with assumptions on protection against infection with the Delta variant provided by either natural infection, vaccination, or both, we estimate that 55% of the region is immune to the Delta variant. In our current reference scenario, we expect that by January 1, 65% of people will be immune to the Delta variant (Figure 21). These two calculations do not take into account waning of natural or vaccine-derived immunity.

Projections

- In our **reference scenario**, which represents what we think is most likely to happen, our model projects 784,000 cumulative reported deaths due to COVID-19 on January 1. This represents 111,000 additional deaths from September 20 to January 1. Daily reported deaths will decline to below 900 by mid-November and then will increase to over 1,000 by early December (Figure 22).
- Under our **reference scenario**, our model projects 1,223,000 cumulative excess deaths due to COVID-19 on January 1. This represents 179,000 additional deaths from September 20 to January 1 (Figure 22).
- If **universal mask coverage (95%)** were attained in the next week, our model projects 52,000 fewer cumulative reported deaths compared to the reference scenario on January 1.
- Under our **worse scenario**, our model projects 898,000 cumulative reported deaths on January 1, an additional 114,000 deaths compared to our reference scenario. Daily reported deaths in the **worse scenario** will rise to 3,500 by mid-December (Figure 22).
- Daily infections in the **reference scenario** will decline to 235,000 by the third week of October and then increase again, reaching 350,000 by the end of the year (Figure 23). Daily infections in the **worse scenario** will rise to 950,000 by mid-November (Figure 23).
- Daily cases in the **reference scenario** will decline to less than 110,000 by the beginning of November and then increase to over 150,000 by the end of the year (Figure 24). Daily cases in the **worse scenario** will rise to 450,000 by the end of November (Figure 24).
- Daily hospital census in the **reference scenario** will decline to 75,000 by November 3, 2021 (Figure 25). Daily hospital census in the **worse scenario** will rise to 300,000 by December 8, 2021 (Figure 25).
- Figure 26 compares our reference scenario forecasts to other publicly archived models. LANL forecasts increasing mortality from early October onward. Other models suggest declines until mid-November. After that date, only the IHME model suggests an increase.

- At some point from September through January 1, 35 states will have high or extreme stress on hospital beds (Figure 27). At some point from September through January 1, 47 states will have high or extreme stress on intensive care unit (ICU) capacity (Figure 28).

Model updates

Previously, our global total for vaccinations was based only on the locations that we produce COVID estimates for. Starting this week, we are including vaccination in all locations in the world that report data on vaccinations. This will ensure vaccination numbers reflect what is happening around the world and are not impacted by the selection of locations that we publish COVID-19 estimates for. We currently only report COVID-19 estimates for locations that have reported greater than 500 cumulative COVID-19 deaths.

Figure 1. Daily COVID-19 hospital census and infections

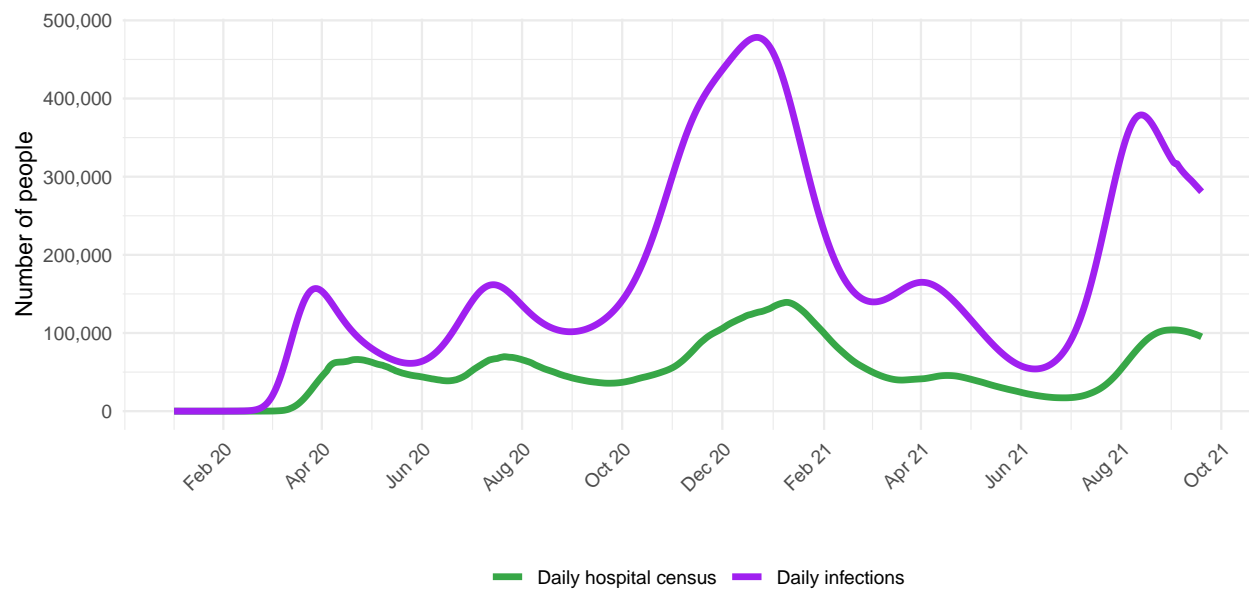


Figure 2. Reported daily COVID-19 cases, moving average

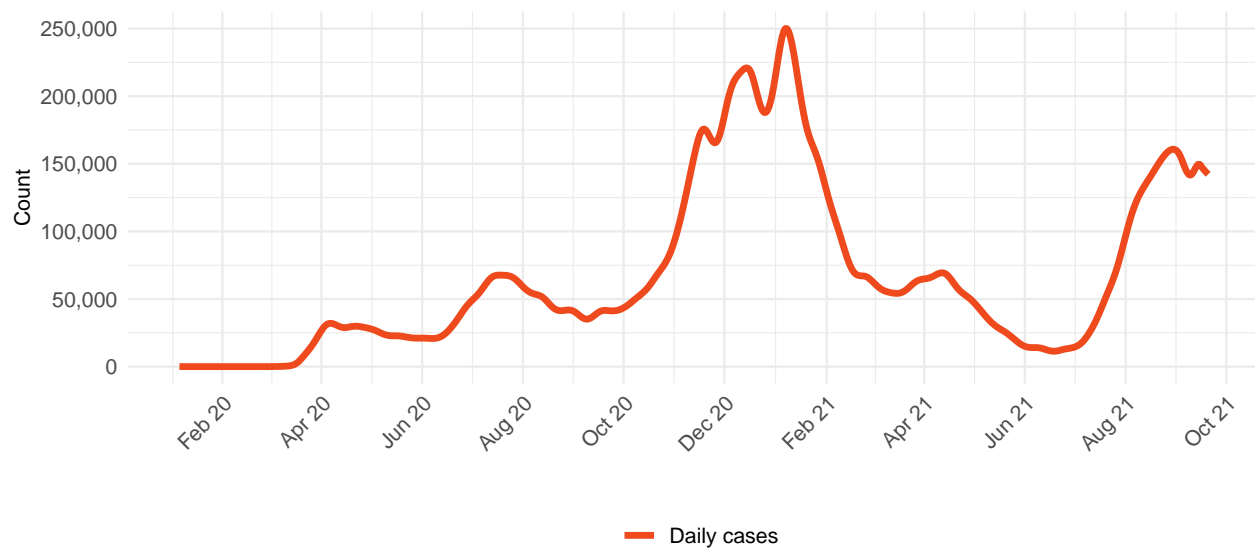


Table 1. Ranking of excess deaths due to COVID-19 among the leading causes of mortality this week, assuming uniform deaths of non-COVID causes throughout the year

Cause name	Weekly deaths	Ranking
COVID-19	20,177	1
Ischemic heart disease	10,724	2
Tracheal, bronchus, and lung cancer	3,965	3
Chronic obstructive pulmonary disease	3,766	4
Stroke	3,643	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. Smoothed trend estimate of reported daily COVID-19 deaths (blue) and excess daily deaths due to COVID-19 (orange)

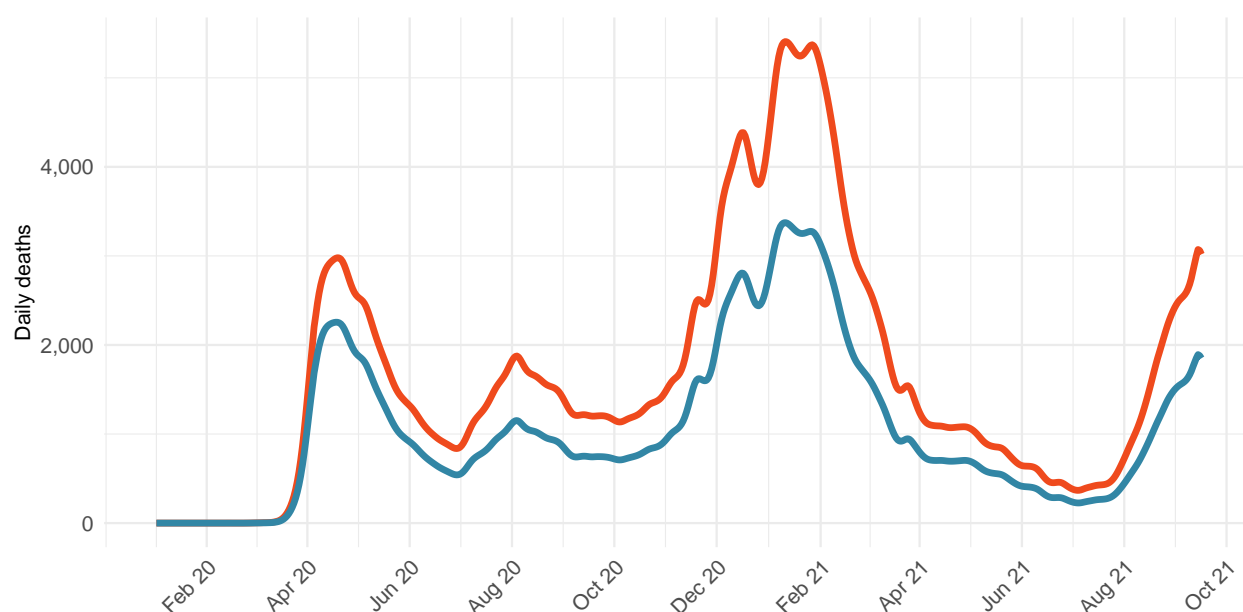
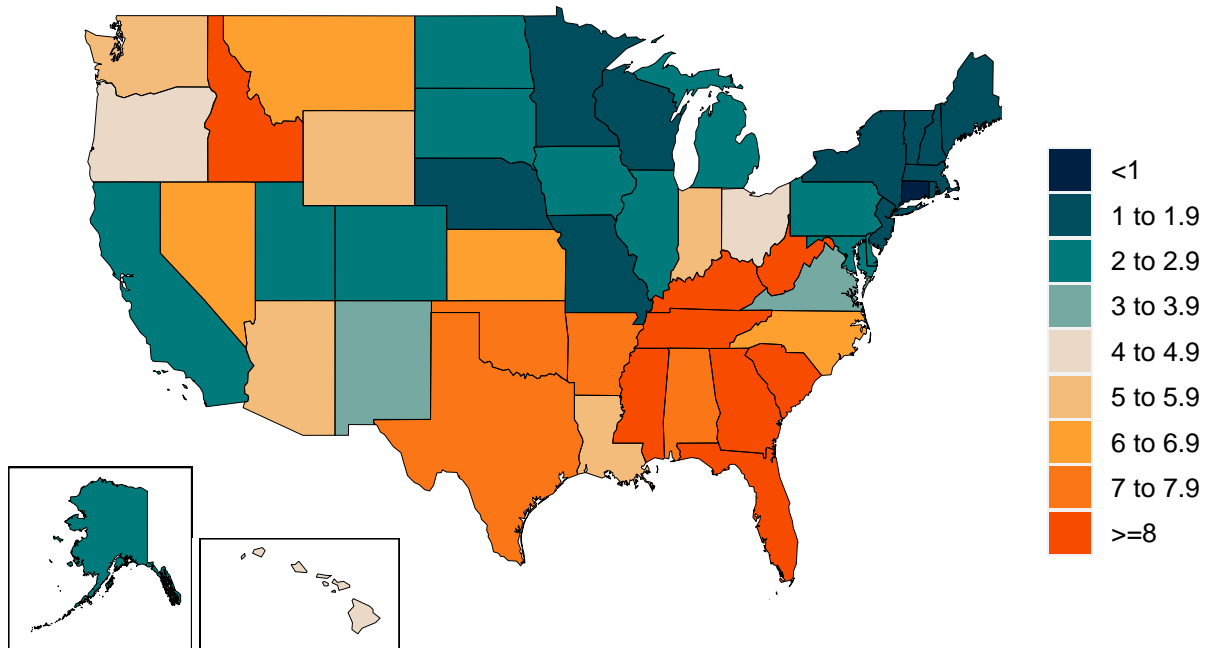


Figure 4. Daily COVID-19 death rate per 1 million on September 20, 2021

A. Daily reported COVID-19 death rate per 1 million



B. Daily excess COVID-19 death rate per 1 million

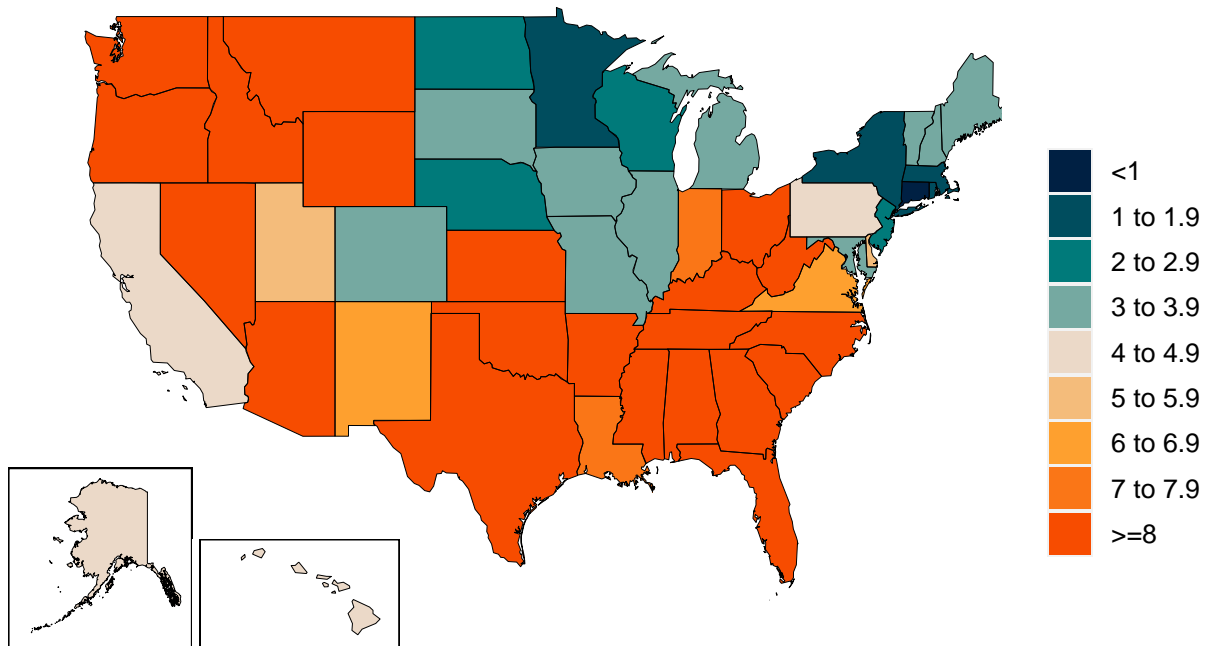
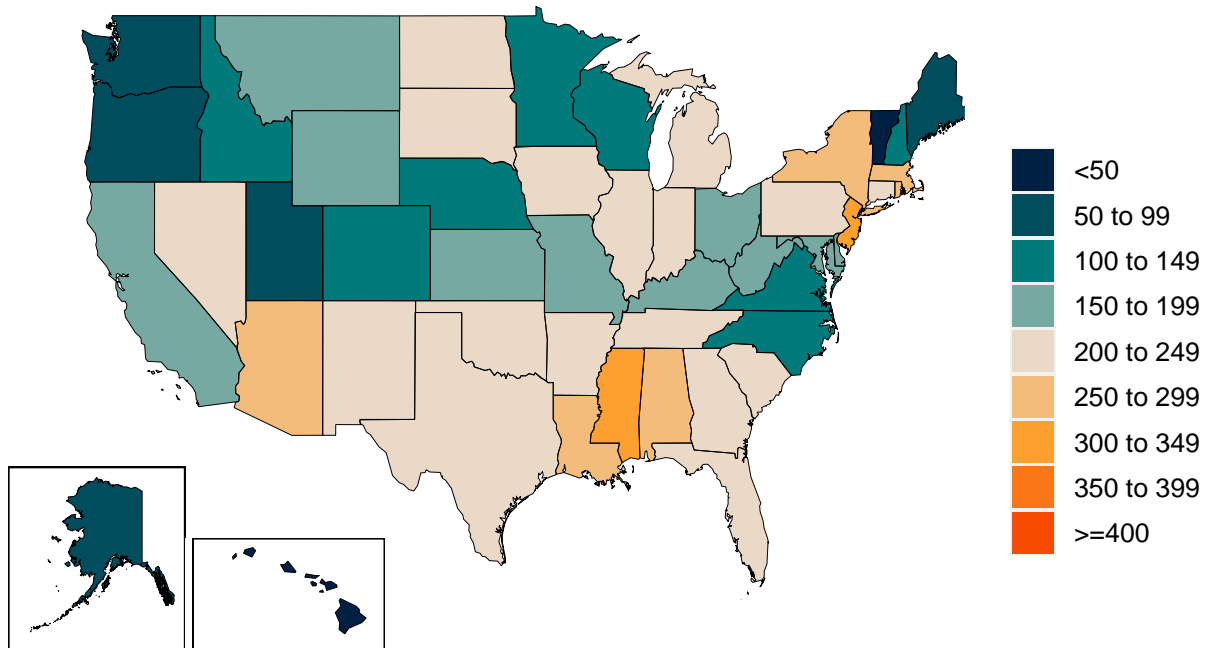


Figure 5. Cumulative COVID-19 deaths per 100,000 on September 20, 2021

A. Reported cumulative COVID-19 deaths per 100,000



B. Excess cumulative COVID-19 deaths per 100,000

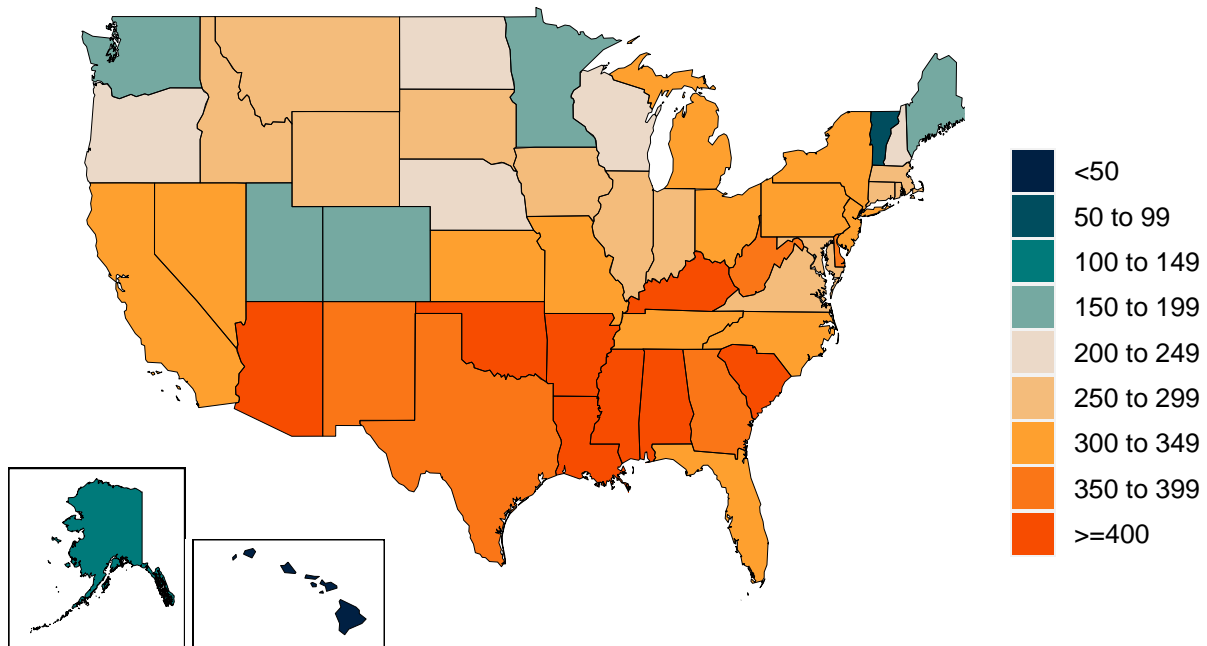


Figure 6. Estimated percent of the population infected with COVID-19 on September 20, 2021

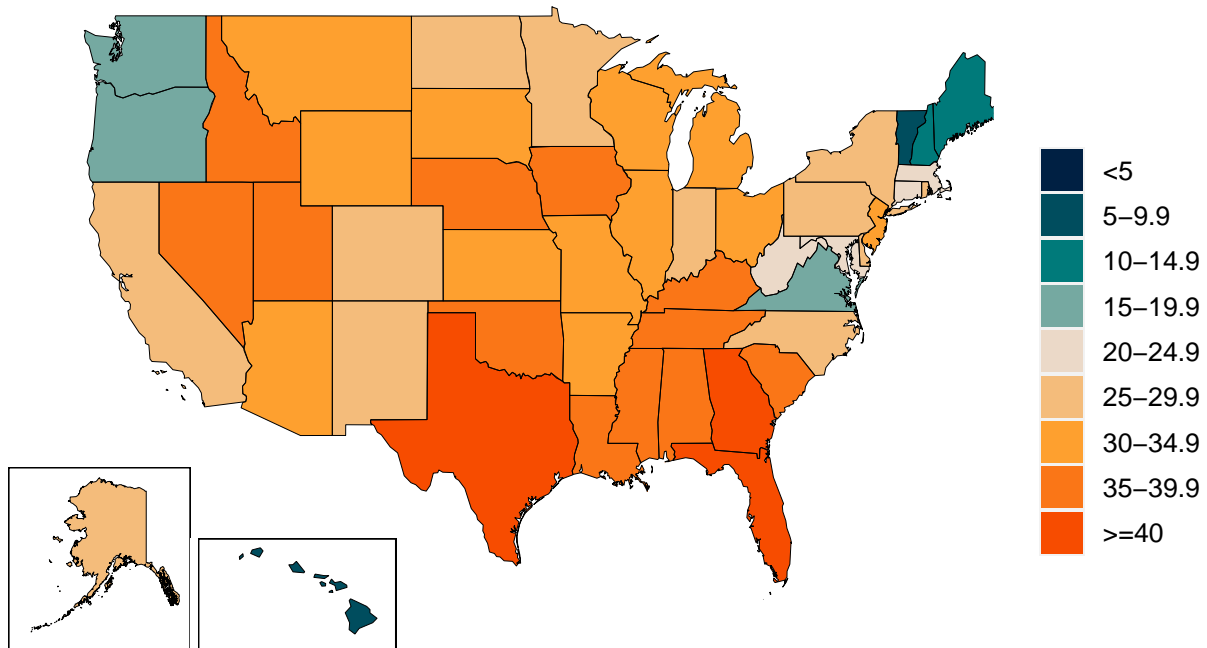


Figure 7. Mean effective R on September 9, 2021. Effective R less than 1 means that transmission should decline, all other things being held the same. The estimate of effective R is based on the combined analysis of deaths, case reporting, and hospitalizations where available. Current reported cases reflect infections 11–13 days prior, so estimates of effective R can only be made for the recent past.

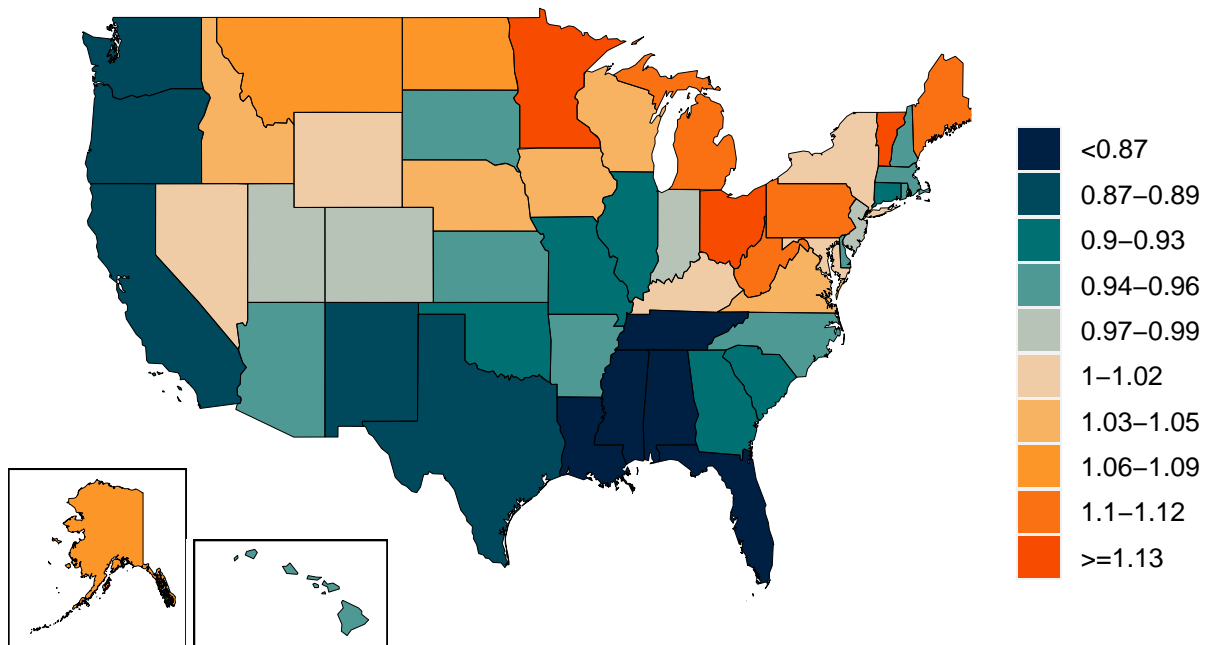


Figure 8. Percent of COVID-19 infections detected. This is estimated as the ratio of reported daily COVID-19 cases to estimated daily COVID-19 infections based on the SEIR disease transmission model. Due to measurement errors in cases and testing rates, the infection-detection rate can exceed 100% at particular points in time.

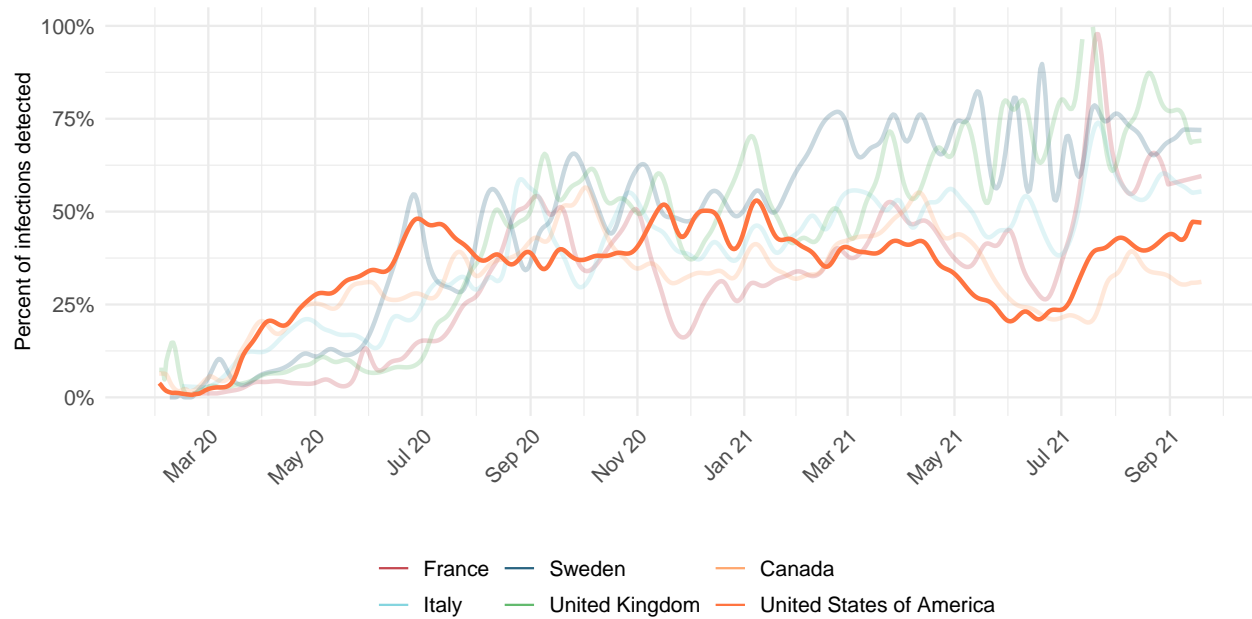
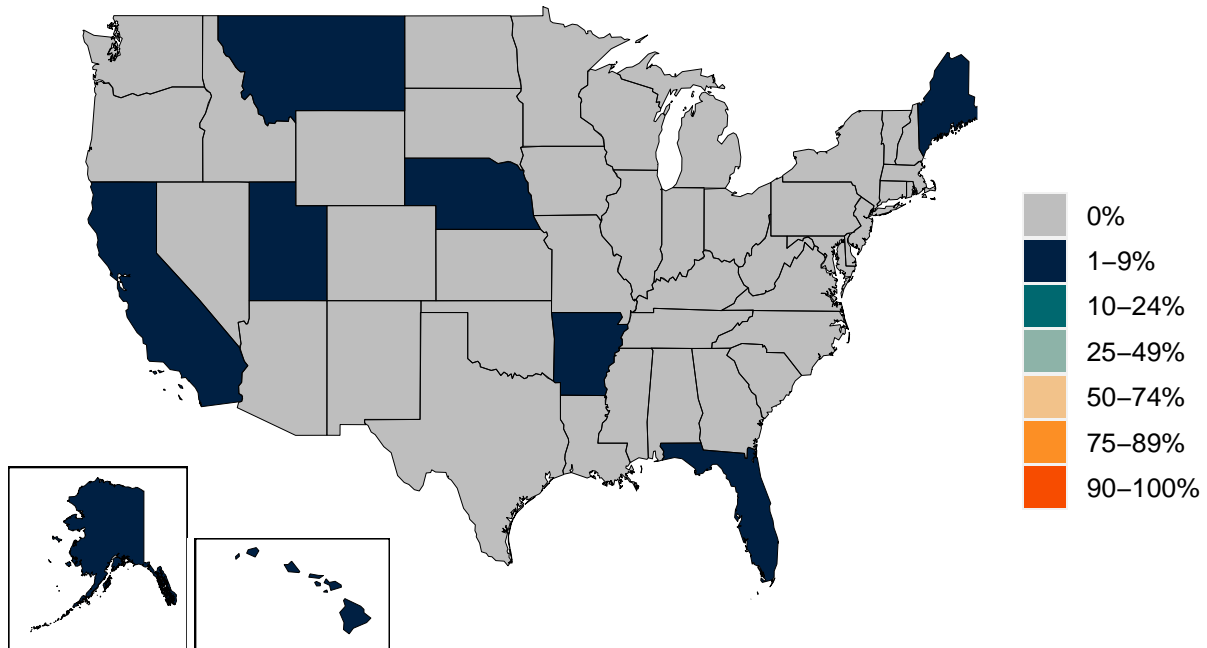
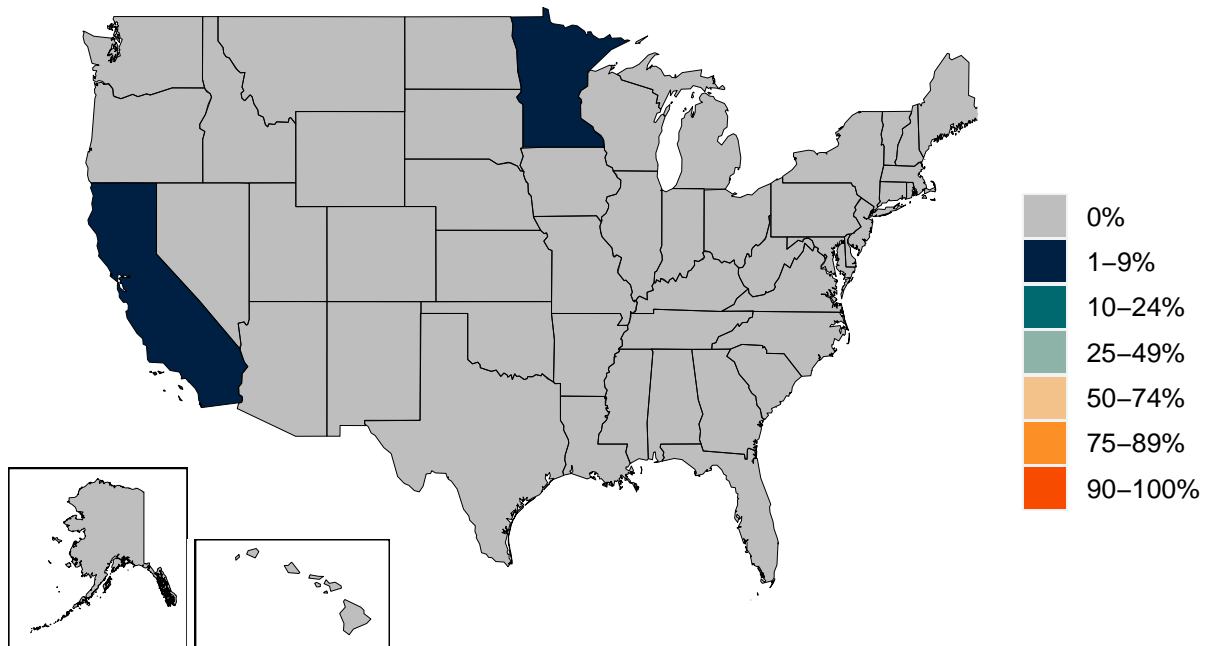


Figure 9. Estimated percent of circulating SARS-CoV-2 for primary variant families on September 20, 2021

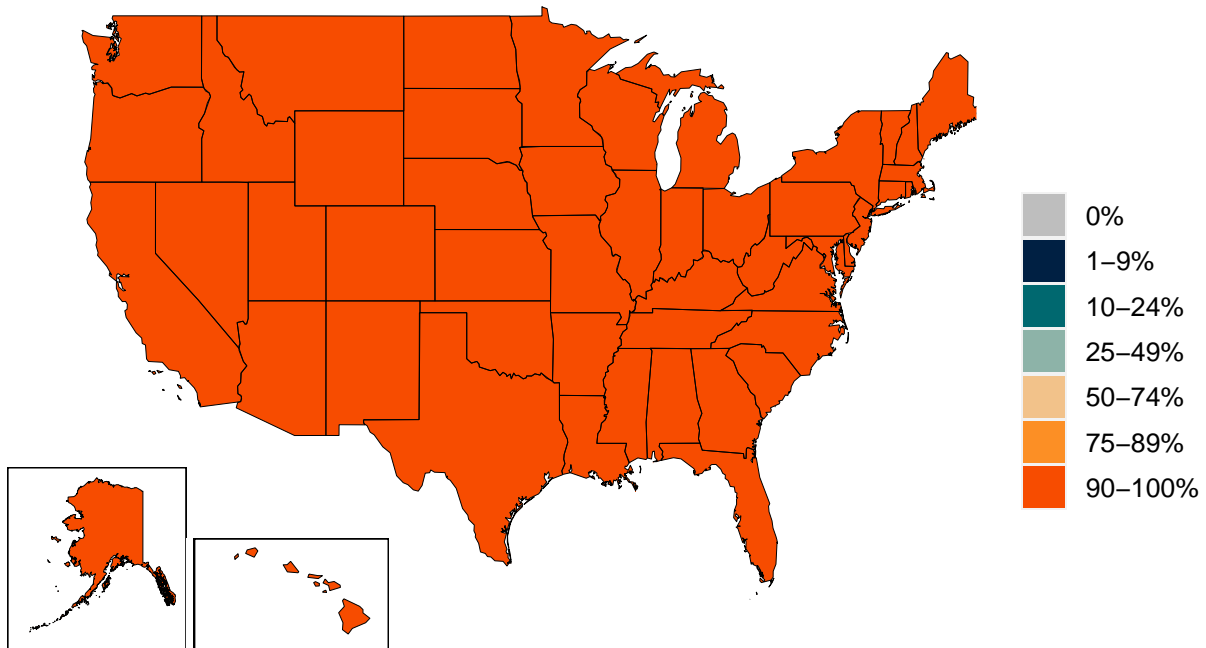
A. Estimated percent Alpha variant



B. Estimated percent Beta variant



C. Estimated percent Delta variant



D. Estimated percent Gamma variant

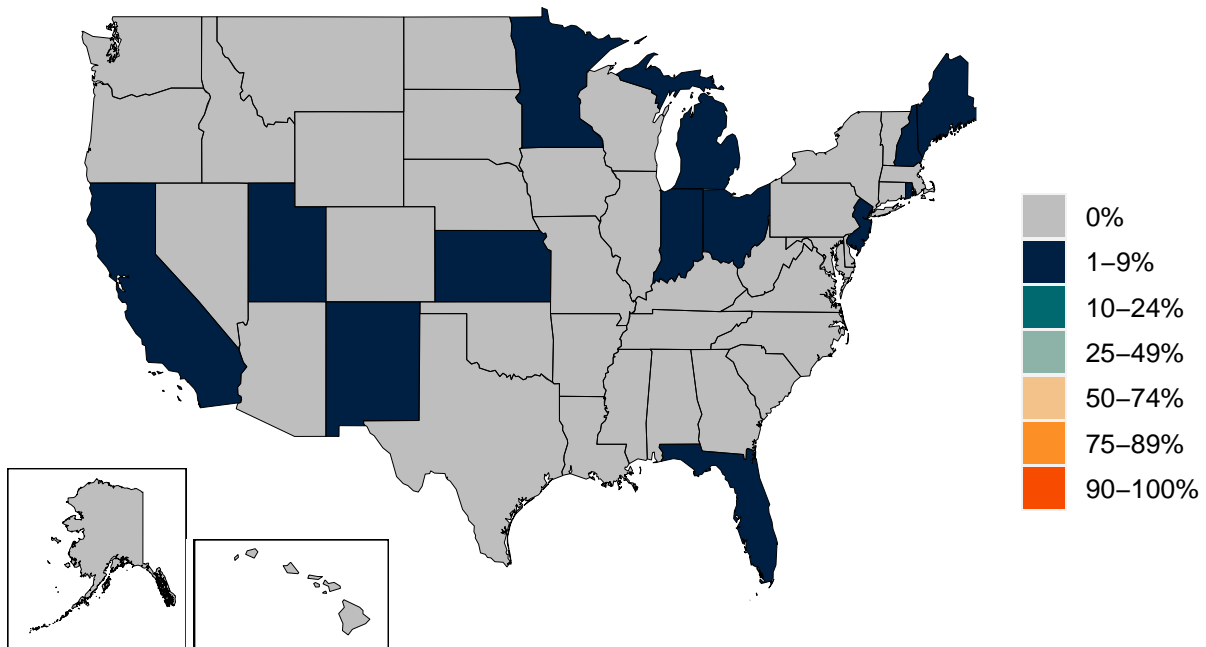
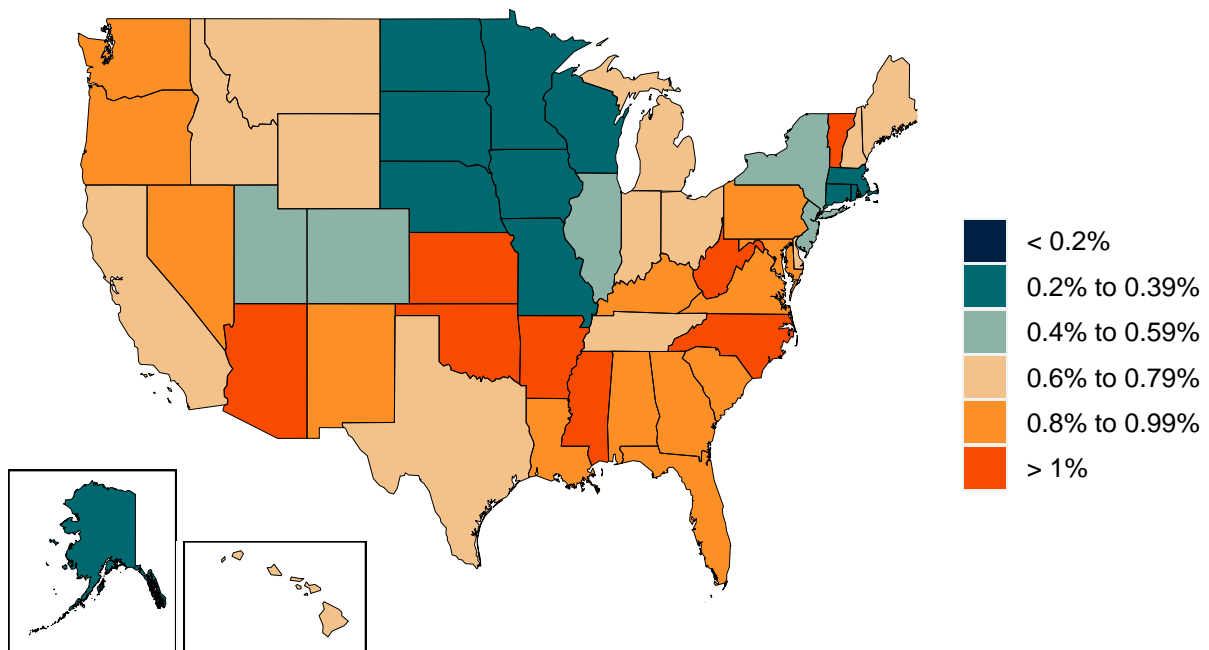


Figure 10. Infection-fatality rate on September 20, 2021. This is estimated as the ratio of COVID-19 deaths to estimated daily COVID-19 infections.



Critical drivers

Table 2. Current mandate implementation

	Primary school closure	Secondary school closure	Higher school closure	Borders closed to any non-resident	Borders closed to 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																									
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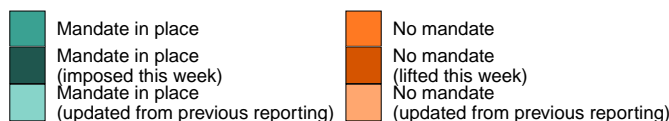


Figure 11. Trend in mobility as measured through smartphone app use, compared to January 2020 baseline

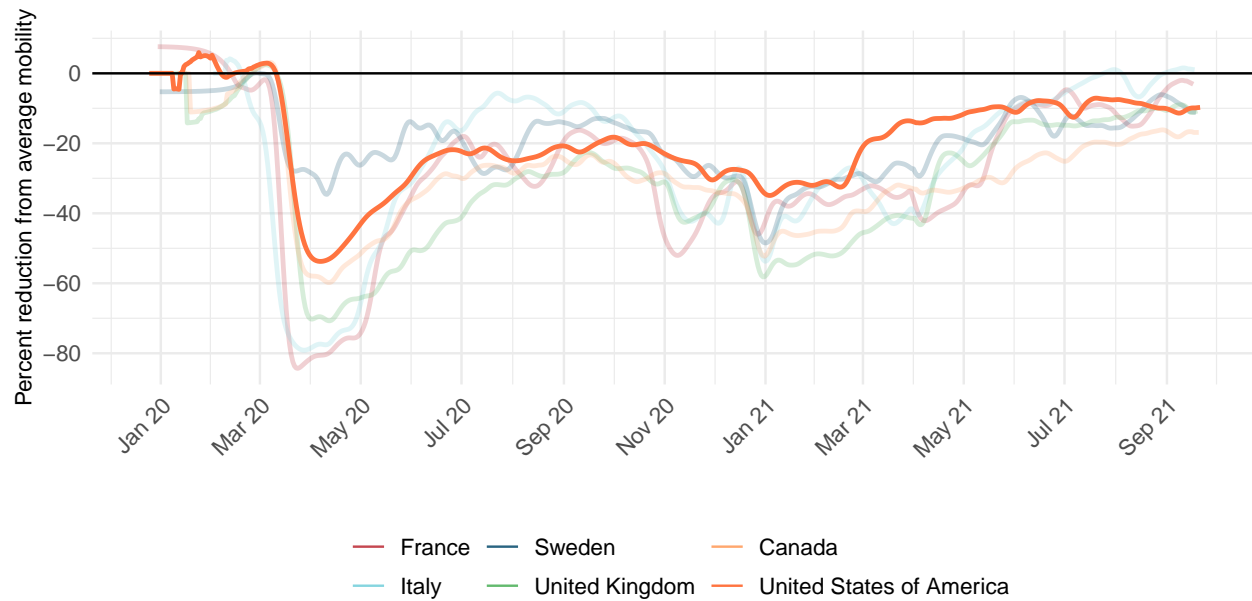


Figure 12. Mobility level as measured through smartphone app use, compared to January 2020 baseline (percent) on September 20, 2021

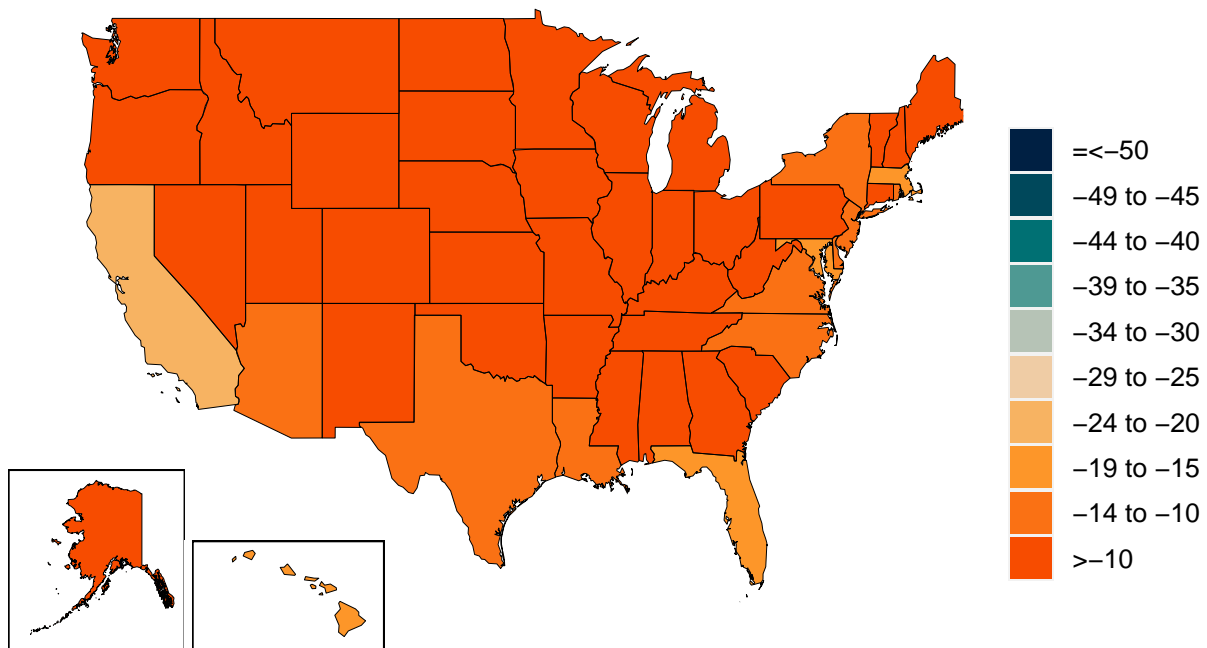


Figure 13. Trend in the proportion of the population reporting always wearing a mask when leaving home

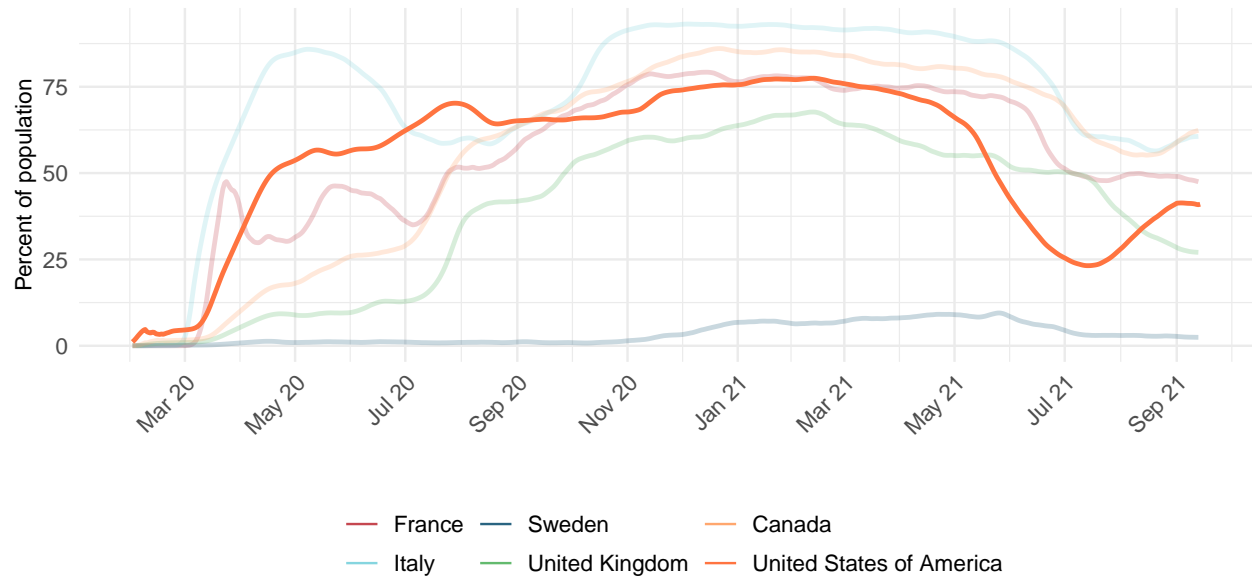


Figure 14. Proportion of the population reporting always wearing a mask when leaving home on September 20, 2021

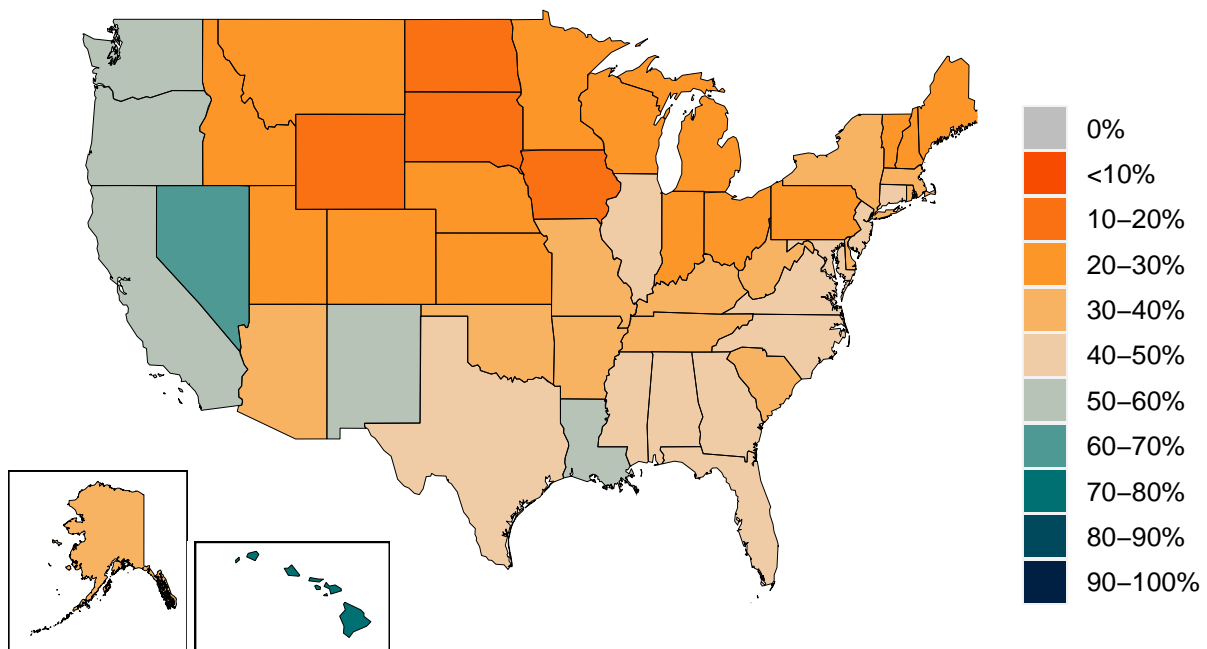


Figure 15. Trend in COVID-19 diagnostic tests per 100,000 people

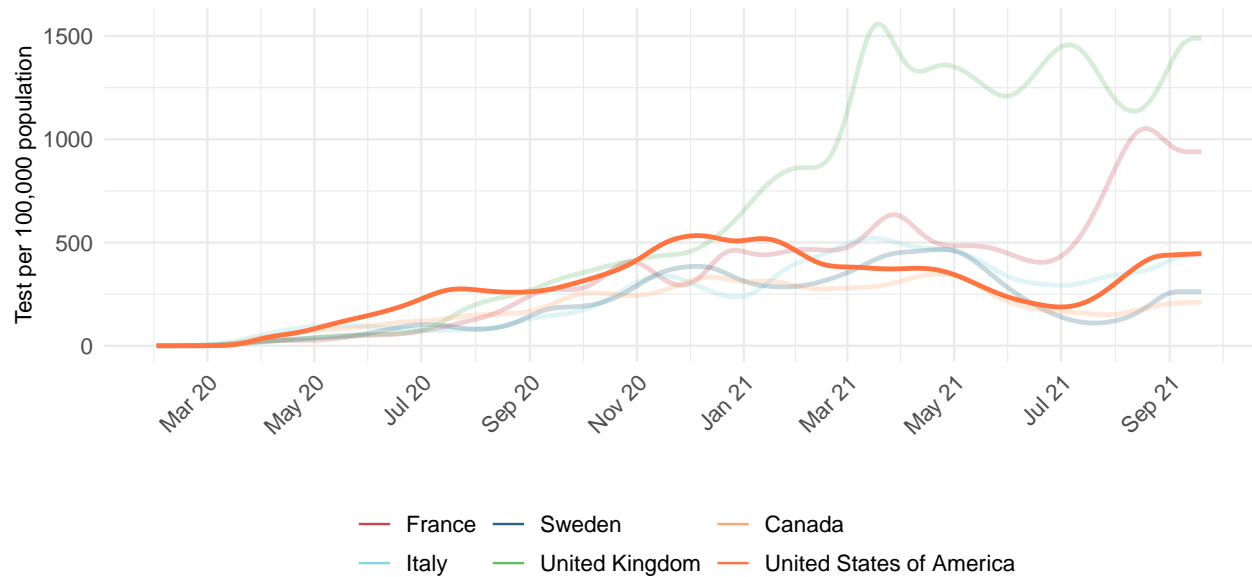


Figure 16. COVID-19 diagnostic tests per 100,000 people on September 20, 2021

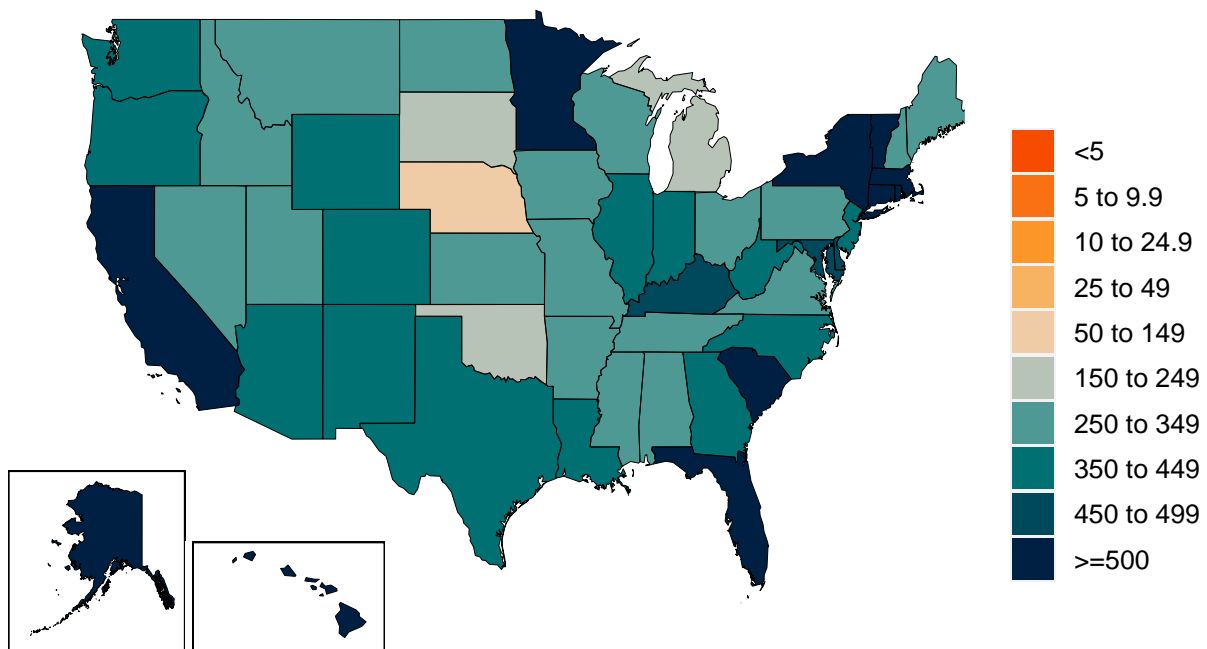
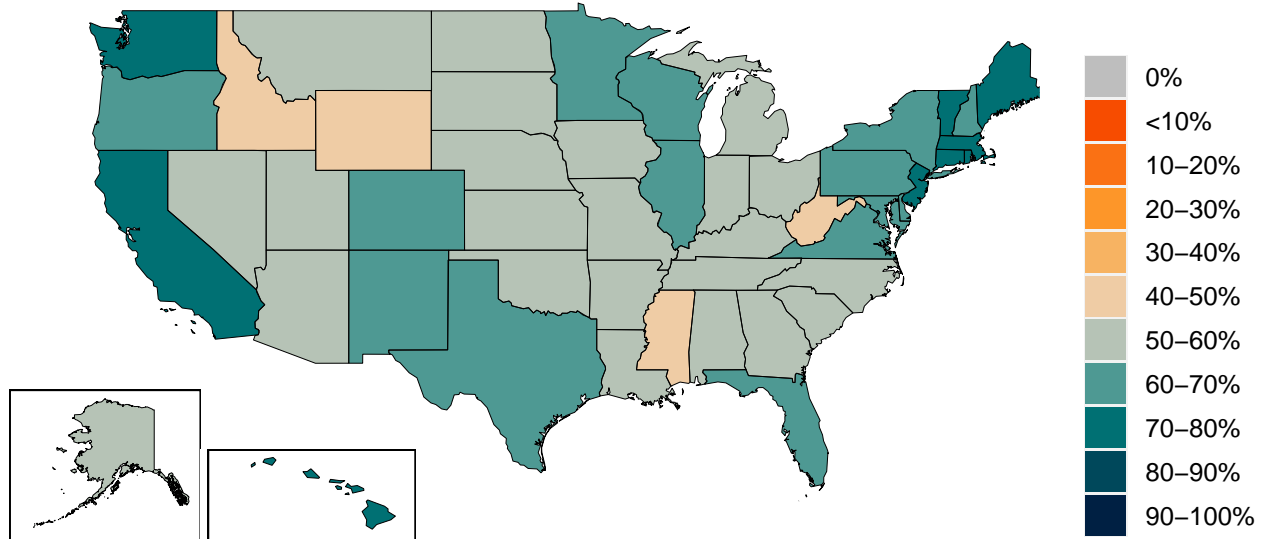


Table 3. Estimates of vaccine efficacy for specific vaccines used in the model at preventing disease and infection. The SEIR model uses variant-specific estimates of vaccine efficacy at preventing symptomatic disease and at preventing infection. We use data from clinical trials directly, where available,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

Vaccine	Efficacy at preventing disease: ancestral and Alpha	Efficacy at preventing infection: ancestral and Alpha	Efficacy at preventing disease: Beta, Delta, & Gamma	Efficacy at preventing infection: Beta, Delta, & Gamma
AstraZeneca	90%	52%	85%	49%
CoronaVac	50%	44%	43%	38%
Covaxin	78%	69%	68%	60%
Johnson & Johnson	86%	72%	60%	56%
Moderna	94%	89%	94%	80%
Novavax	89%	79%	79%	69%
Pfizer/BioNTech	94%	86%	85%	78%
Sinopharm	73%	65%	63%	56%
Sputnik-V	92%	81%	80%	70%
Tianjin	66%	58%	57%	50%
CanSino				
Other vaccines	75%	66%	65%	57%
Other vaccines (mRNA)	91%	86%	85%	78%

Figure 17. Percent of the population (A) having received at least one dose and (B) fully vaccinated against SARS-CoV-2 by September 20, 2021

A. Percent of the population having received one dose of a COVID-19 vaccine



B. Percent of the population fully vaccinated against SARS-CoV-2

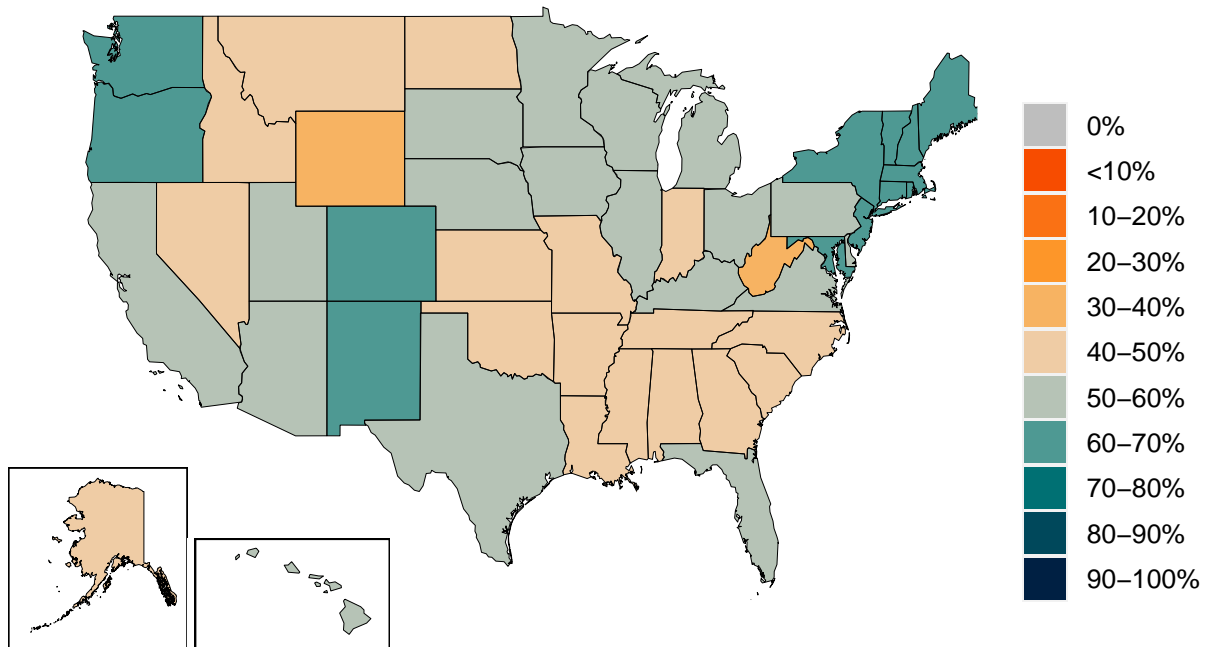


Figure 18. Trend in the estimated proportion of the adult (18+) population that have been vaccinated or would probably or definitely receive the COVID-19 vaccine if available

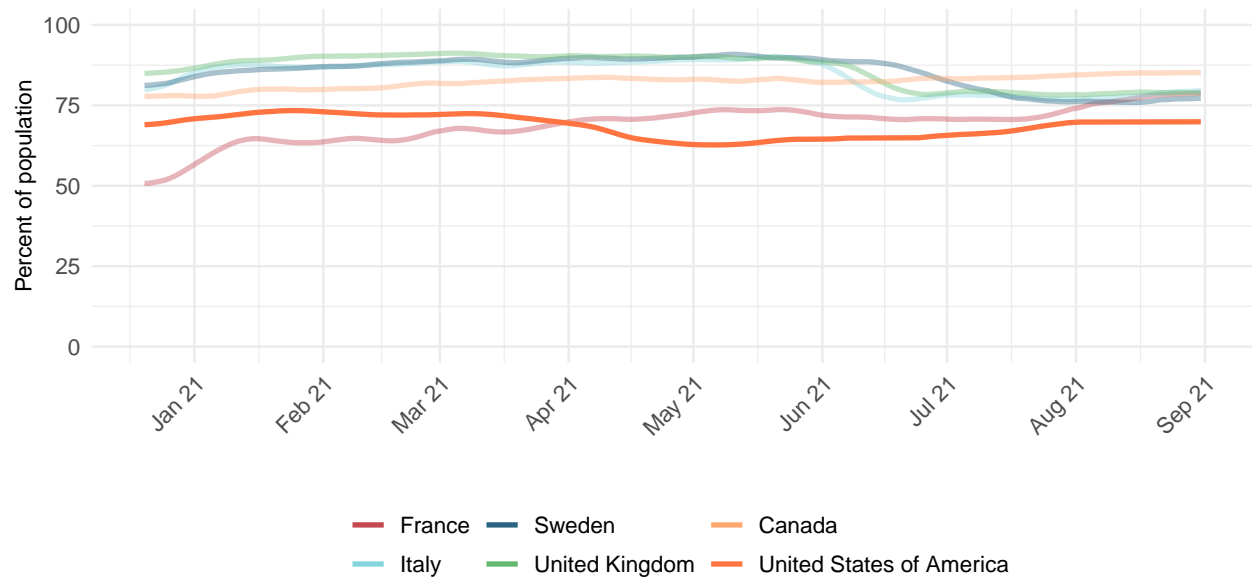


Figure 19. This figure shows the estimated proportion of the adult (18+) population that has been vaccinated or would probably or definitely receive the COVID-19 vaccine if available

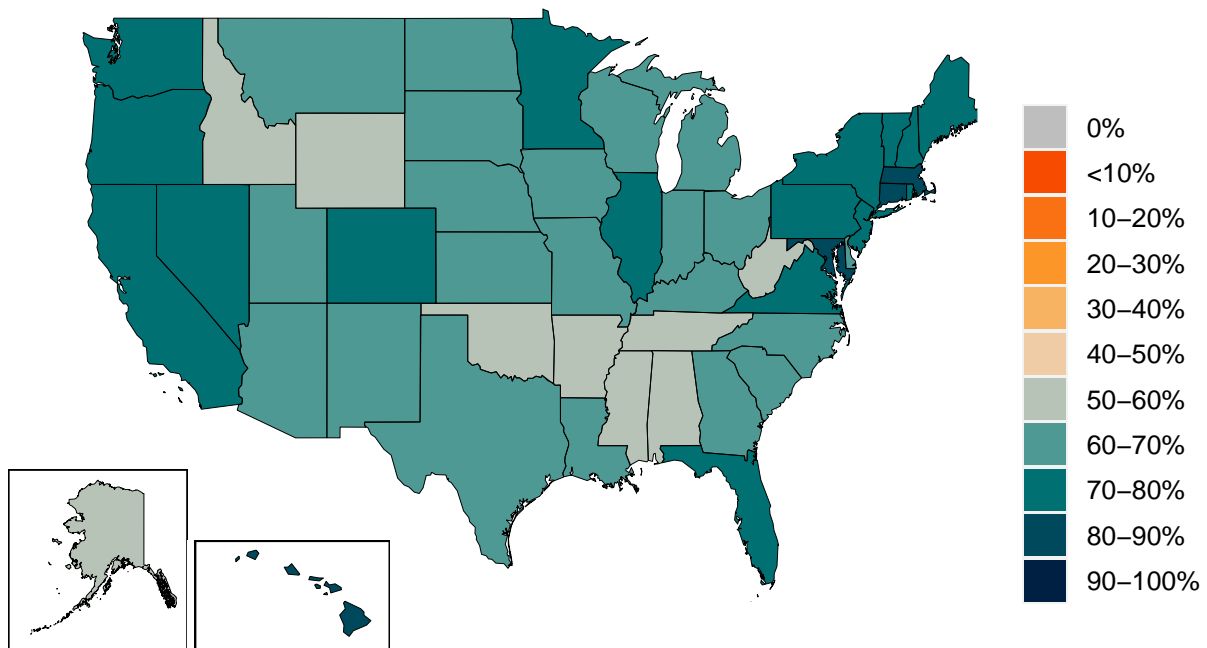


Figure 20. Percent of people who receive at least one dose of a COVID-19 vaccine and those who are fully vaccinated

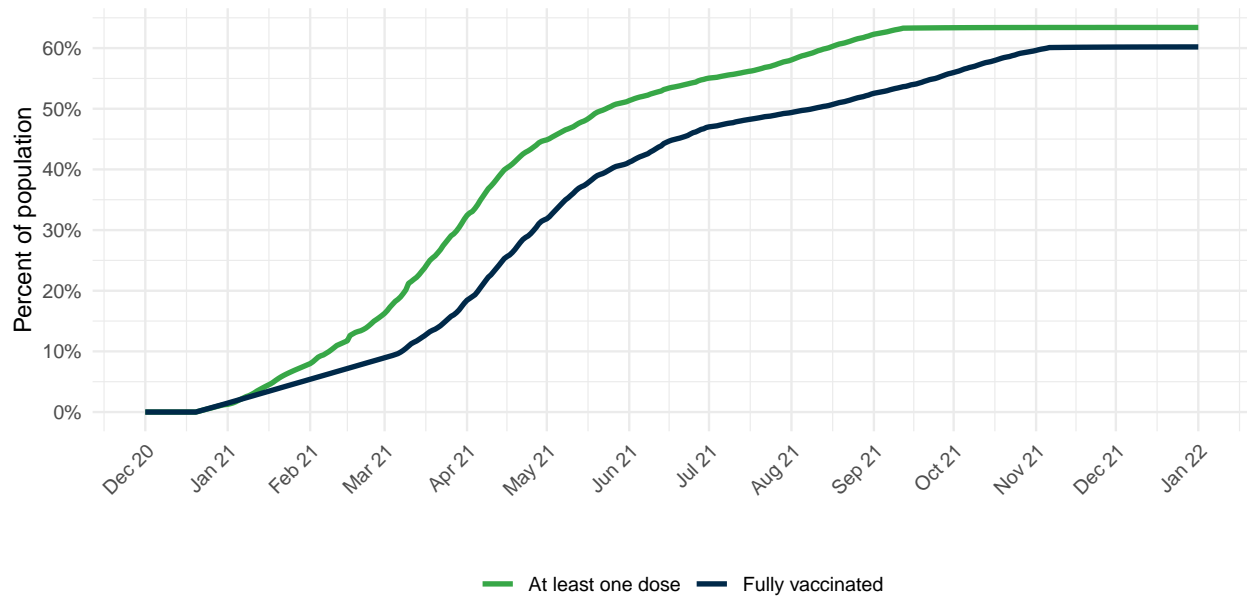
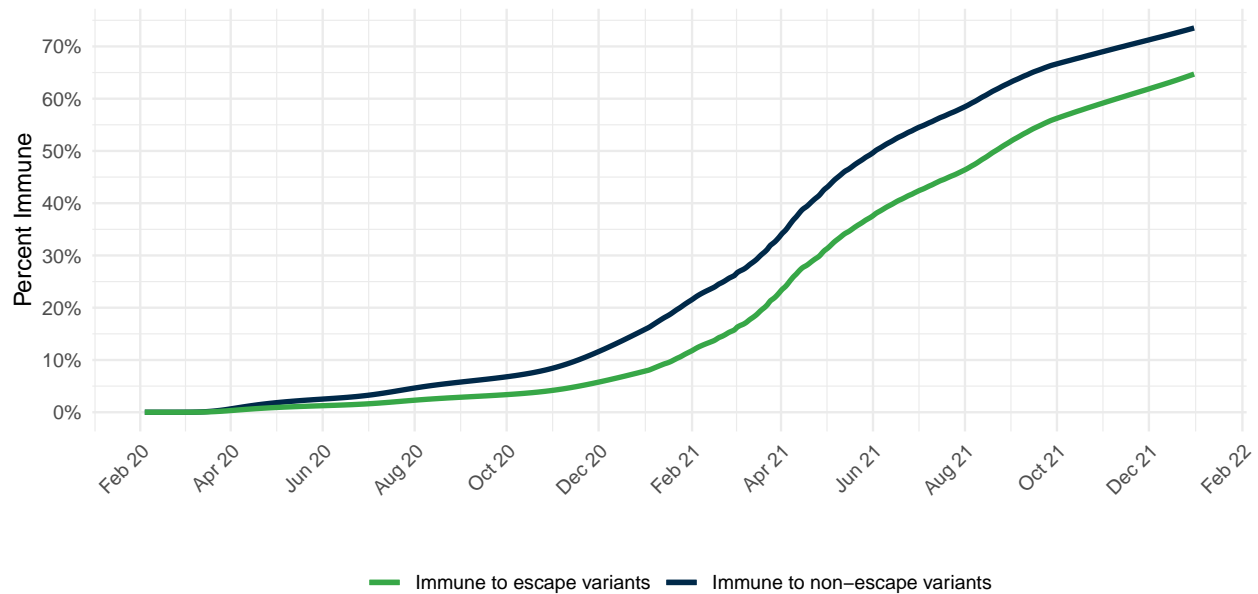


Figure 21. Percentage of people who are immune to non-escape variants and the percentage of people who are immune to escape variants



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 is the mean of mask use over the last 7 days.
- Mobility increases as vaccine coverage increases.
- Governments adapt their response by re-imposing social distancing mandates for 6 weeks whenever daily deaths reach 8 per million, unless a location has already spent at least 7 of the last 14 days with daily deaths above this rate, and not yet re-imposed social distancing mandates. In this case, the reference scenario assumes that mandates are re-imposed when daily deaths reach 15 per million.
- Variants Alpha, Beta, Gamma, and Delta continue to spread regionally and globally from locations with sufficient transmission.

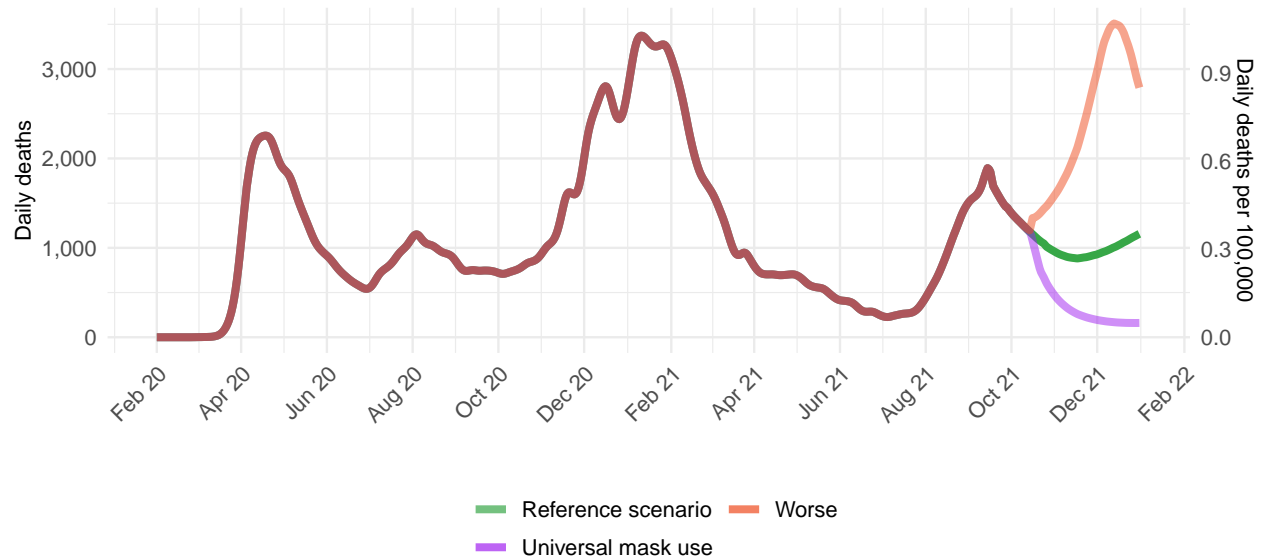
The **worse scenario** modifies the reference scenario assumption in four ways:

- 100% of vaccinated individuals stop using masks.
- Mobility increases in all locations to 25% above the pre-pandemic winter baseline, irrespective of vaccine coverage.
- Governments are more reluctant to re-impose social distancing mandates, waiting until the daily death rate reaches 15 per million, unless a location has already spent at least 7 of the last 14 days with daily deaths above this rate, and not yet re-imposed social distancing mandates. In this case, the reference scenario assumes that mandates are re-imposed when daily deaths reach 38 per million. In either case, we assume social distancing mandates remain in effect for 6 weeks.
- Variants Alpha, Beta, Gamma, and Delta spread between locations twice as fast when compared with our reference scenario.

The **universal masks scenario** makes all the same assumptions as the reference scenario but assumes all locations reach 95% mask use within 7 days.

Figure 22. Daily COVID-19 deaths until January 01, 2022 for three scenarios

A. Reported daily COVID-19 deaths per 100,000



B. Excess daily COVID-19 deaths per 100,000

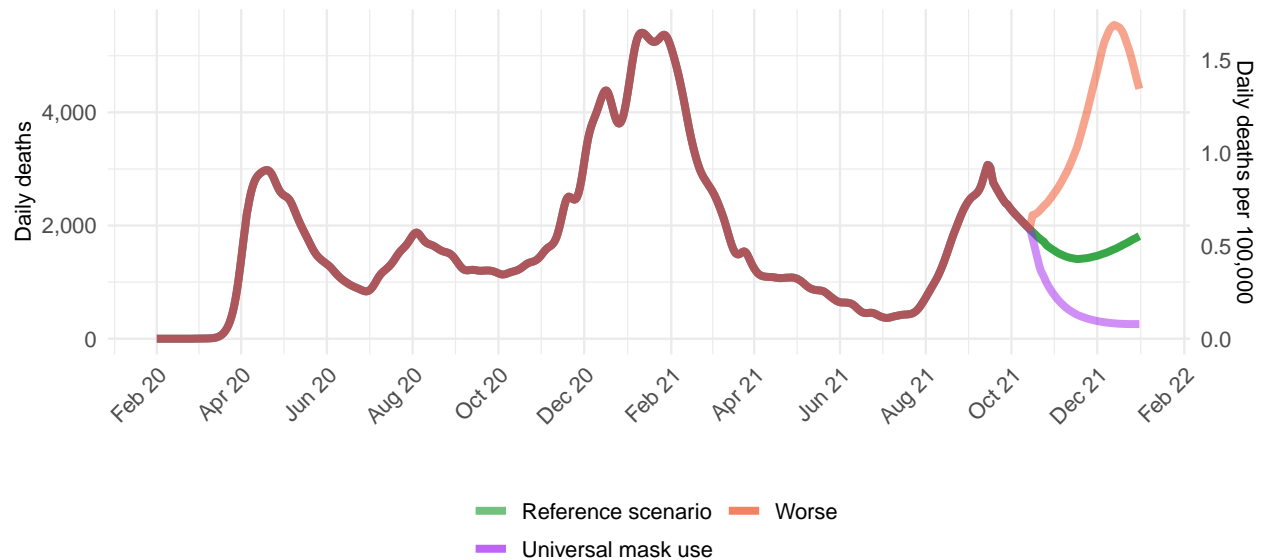


Figure 23. Daily COVID-19 infections until January 01, 2022 for three scenarios

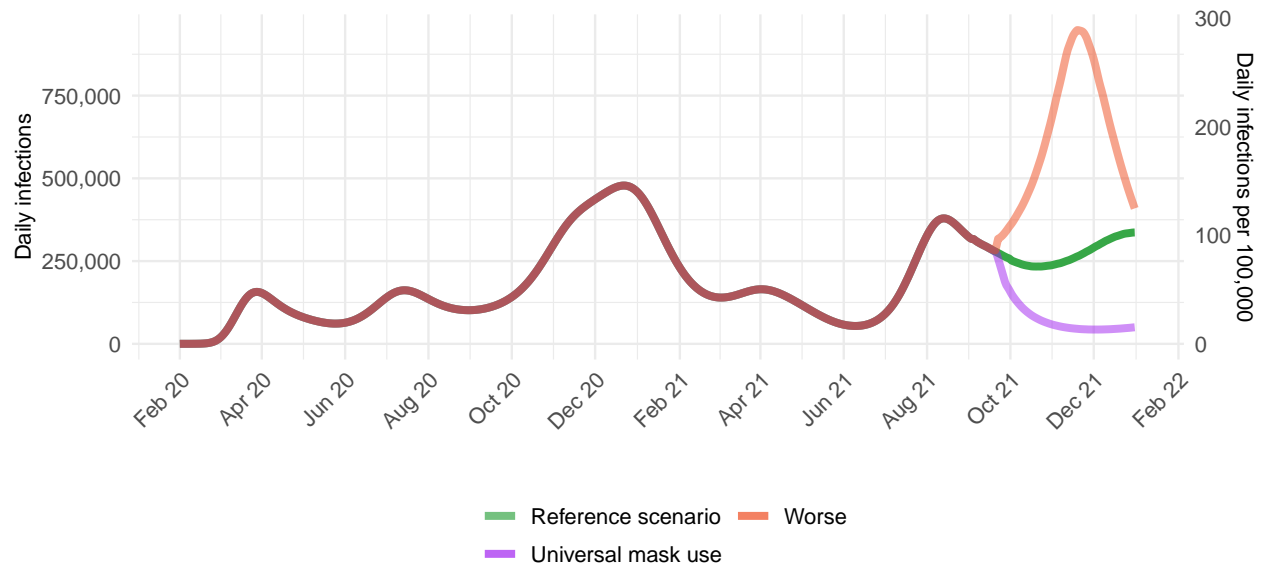


Figure 24. Daily COVID-19 reported cases until January 01, 2022 for three scenarios

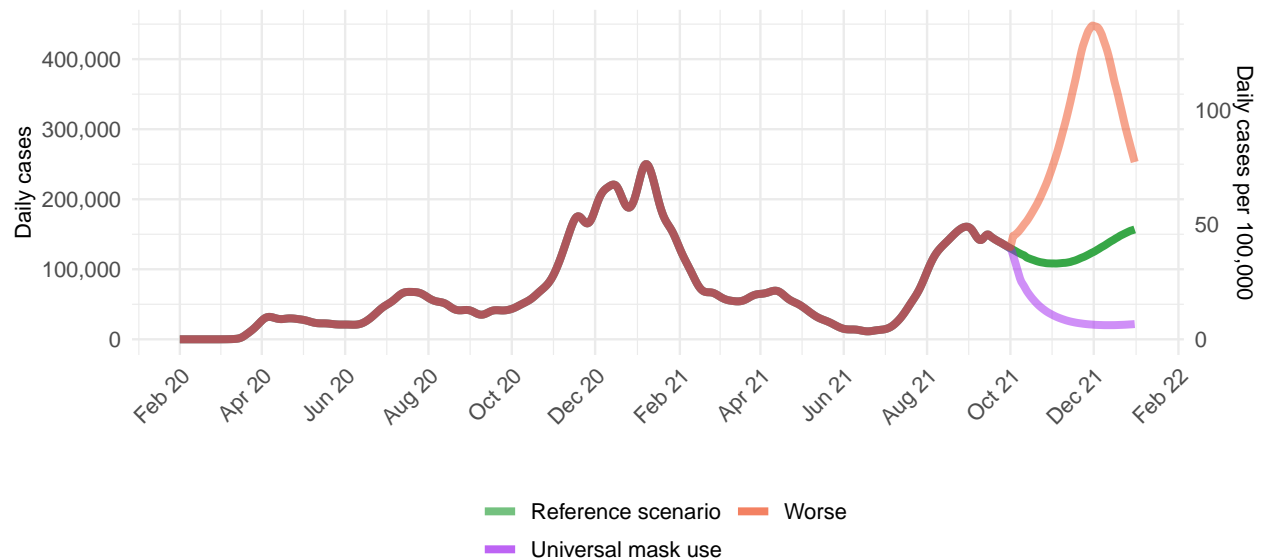


Figure 25. Daily COVID-19 hospital census until January 01, 2022 for three scenarios

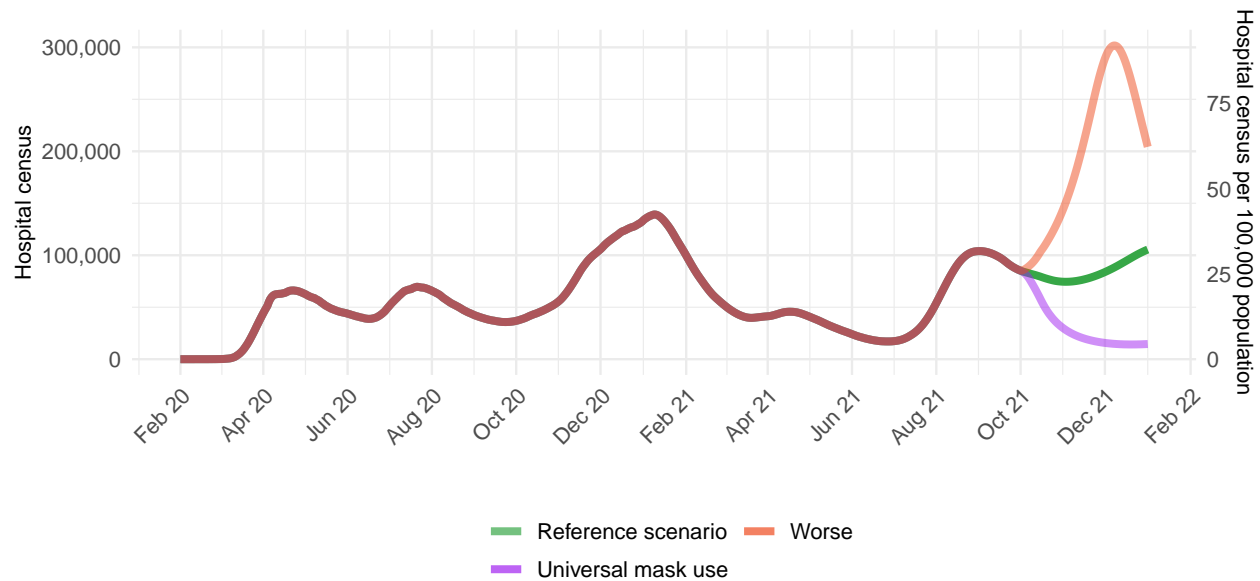


Figure 26. Comparison of reference model projections with other COVID modeling groups. For this comparison, we are including projections of daily COVID-19 deaths from other modeling groups when available: Delphi from the Massachusetts Institute of Technology ([Delphi](#)), Imperial College London ([Imperial](#)), The Los Alamos National Laboratory ([LANL](#)), the SI-KJalpha model from the University of Southern California ([SIKJalpha](#)), and the CDC Ensemble Model ([CDC](#)). Daily deaths from other modeling groups are smoothed to remove inconsistencies with rounding. Regional values are aggregates from available locations in that region.

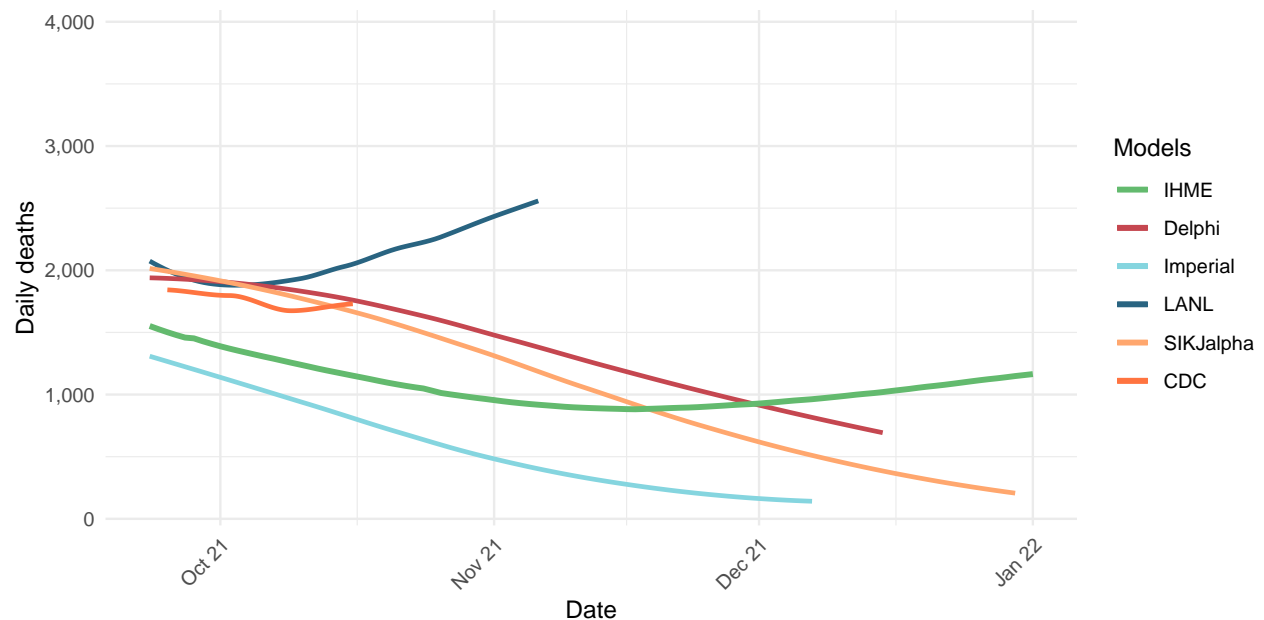


Figure 27. The estimated inpatient hospital usage is shown over time. The percent of hospital beds occupied by COVID-19 patients is color-coded based on observed quantiles of the maximum proportion of beds occupied by COVID-19 patients. Less than 5% is considered *low stress*, 5-9% is considered *moderate stress*, 10-19% is considered *high stress*, and 20% or greater is considered *extreme stress*.

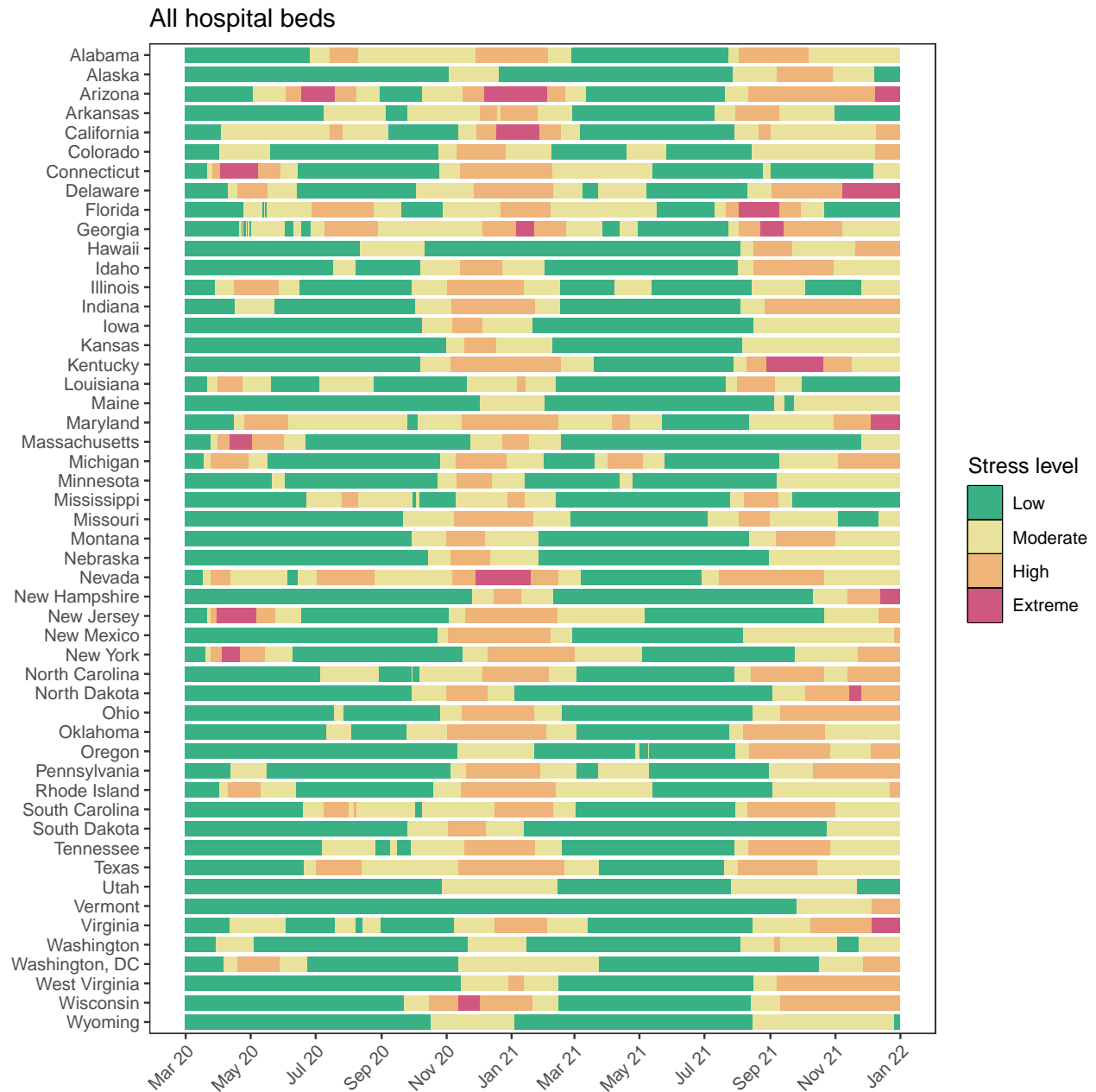
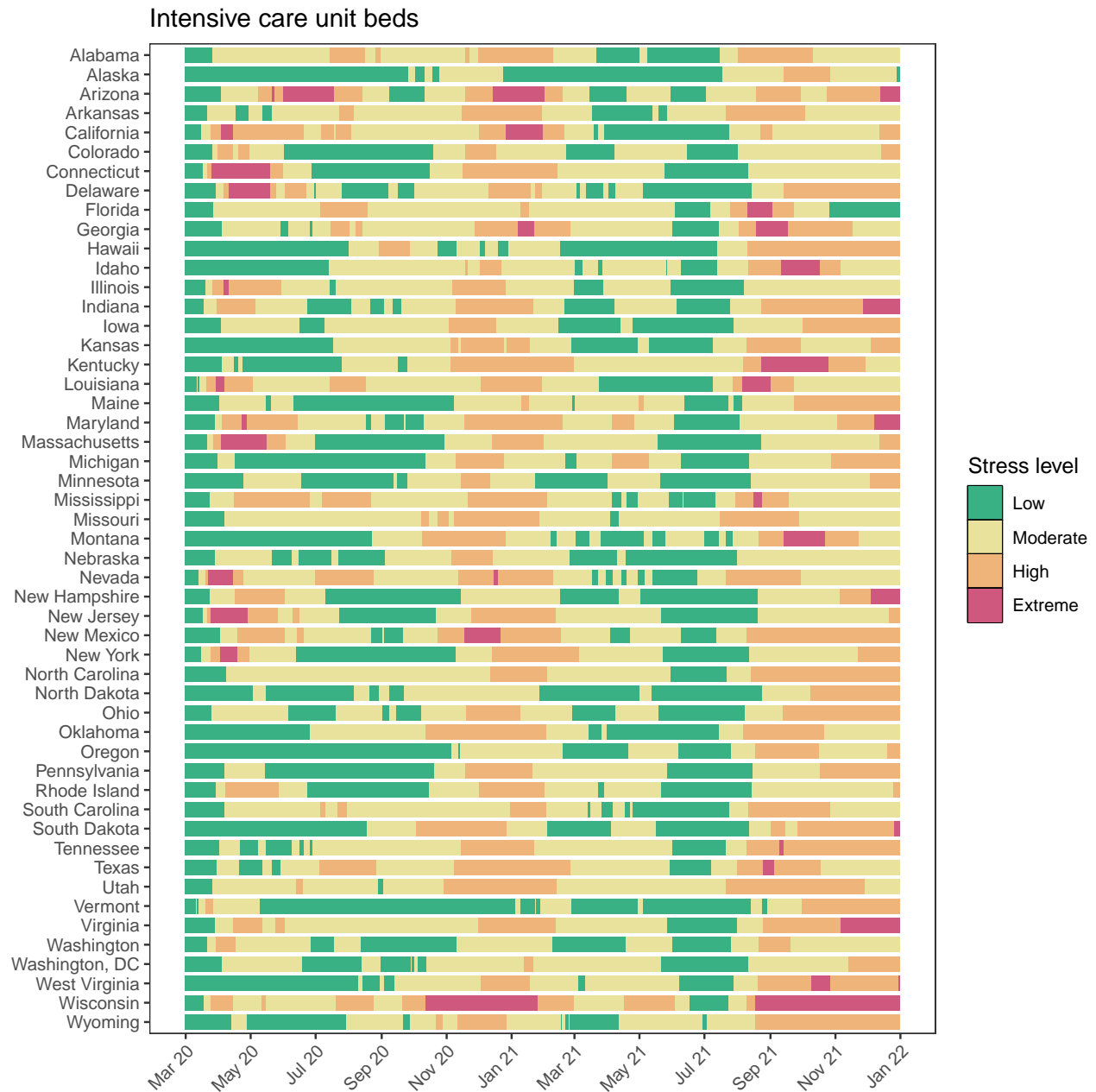


Figure 28. The estimated intensive care unit (ICU) usage is shown over time. The percent of ICU beds occupied by COVID-19 patients is color-coded based on observed quantiles of the maximum proportion of ICU beds occupied by COVID-19 patients. Less than 10% is considered *low stress*, 10-29% is considered *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>.