COVID-19 Results Briefing

The United States of America

October 1, 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 28, 2021, with data through September 27, 2021.

At the national level, peak transmission of the Delta variant was at the end of August, leading to peaks of cases in early September and peaks of hospitalization census by mid-September. The lag between the peak of cases and deaths appears to have lengthened so that deaths have yet to peak but should peak in the next week. Within the country, the course of the Delta surges follows a strong geographic pattern, with Southern states well into the decline of transmission and many Northern states still increasing. We expect declines in all the key indicators to continue through October, and then, due to winter seasonality, transmission should increase somewhat in November and December. Based on the state, the trends are driven by a number of key factors: First, the timing of the Delta surge, with earlier Delta surges in the South and later surges in the North. Second, the balance of what percentage of the population has been previously infected and what percentage has been fully vaccinated. Natural infection and vaccination influence population-level immunity – there is a negative correlation between levels of previous infection and levels of vaccination. Our model does not include any major shift in the fraction of the vaccine-hesitant who get vaccinated due to the federal employer mandates. Third, whether school openings will trigger secondary Delta surges, as have been seen in Scotland and some parts of England. This depends on the mitigation efforts, including mask use in schools. Fourth, we assume the incremental effect of seasonality on transmission remains the same as in the last year, but the impact on Delta could be different. Our reference forecast of the COVID-19 hospital census for the end of December is approximately 20% lower than last year at the same time; given the likelihood of much more flu transmission this year, late December and early 2022 pressure on hospital systems from the combination of COVID-19 and flu could be greater than last year. There has been some behavioral response to the Delta surge: mask use increased from 20% to over 40%, and mobility has remained on average a little below pre-COVID-19 baseline. As case numbers decline, these behavioral modifications may subside, adding to the potential for winter seasonal transmission. Efforts to enhance vaccination rates, including boosters for at-risk individuals through vaccine mandates and/or requirements for vaccination to enter some businesses, should help. Promoting seasonal mask use has the potential to save many lives over the next months. Our model does not yet take into account waning immunity after natural infection or vaccination, nor does it build in the possibility of the emergence of new variants.

Current situation

- Estimated daily infections in the last week decreased to 265,800 per day on average compared to 281,500 the week before (Figure 1).

- Daily hospital census in the last week (through September 27) decreased to 84,500 per day on average compared to 94,800 the week before.
- Daily reported cases in the last week decreased to 147,300 per day on average compared to 158,800 the week before (Figure 2).
- Reported deaths due to COVID-19 in the last week decreased to 1,800 per day on average compared to 1,900 the week before (Figure 3).
- Excess deaths due to COVID-19 in the last week decreased to 3,000 per day on average compared to 3,100 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 26 states (Figure 4).
- The daily rate of excess deaths due to COVID-19 is greater than 4 per million in 36 states (Figure 4).
- We estimate that 33% of people in the US have been infected as of September 27 (Figure 6).
- Effective R, computed using cases, hospitalizations, and deaths, is greater than 1 in 18 states (Figure 7). These states are all in the Northern half of the country.
- The infection-detection rate in the US was close to 41% on September 27 (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 the dominant variant in all US states.

Trends in drivers of transmission

- Very few state-wide mandates remain in place in the US (Table 2). Eight states have mask mandates, and five states have some form of gathering restrictions.
- Mobility last week was 7% lower than the pre-COVID-19 baseline (Figure 11). Mobility was near baseline (within 10%) in 42 states. Lower levels of mobility are seen in California, Arizona, Louisiana, Florida, New York, Maryland, Massachusetts, and Hawaii.
- As of September 27, 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). Mask use increased from a low of 25% in mid-July to just over 40% by early September and has stayed at this level for more than two weeks. Mask use is over 50% on the West Coast, and in Nevada, New Mexico, and Hawaii.
- There were 487 diagnostic tests per 100,000 people on September 27 (Figure 15).

- As of September 27, 12 states have reached 70% or more of the population who have received at least one vaccine dose, and one state has reached 70% or more of the population who are fully vaccinated (Figure 17). Single-dose vaccination is less than 50% of the total population in Idaho, Wyoming, Mississippi, and West Virginia.
- In the US, 77.4% of the population 12 years and older say they would accept or would probably accept a vaccine for COVID-19. Note that vaccine acceptance is calculated using survey data from the 18+ population. The proportion of the population 12 and over who are open to receiving a COVID-19 vaccine ranges from 57% in West Virginia to 92% in Massachusetts (Figure 19).
- In our current reference scenario, we expect that 210.1 million people will be vaccinated with at least one dose by January 1 (Figure 20). We expect that 61% 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 56% of the US 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 788,000 cumulative reported deaths due to COVID-19 on January 1. This represents 101,000 additional deaths from September 27 to January 1. Daily reported deaths will decline to below 900 by late November and then increase slowly (Figure 22).
- Under our **reference scenario**, our model projects 1,230,000 cumulative excess deaths due to COVID-19 on January 1. This represents 162,000 additional deaths from September 27 to January 1 (Figure 22).
- If **universal mask coverage (95%)** were attained in the next week, our model projects 44,000 fewer cumulative reported deaths compared to the reference scenario on January 1.
- Under our **worse scenario**, our model projects 890,000 cumulative reported deaths on January 1, an additional 102,000 deaths compared to our reference scenario. Daily reported deaths in the **worse scenario** will rise to over 3,450 by late December (Figure 22).
- Daily infections in the **reference scenario** will rise to over 310,000 by the end of the year (Figure 23). Daily infections in the **worse scenario** will rise to nearly 1.0 million by the end of November (Figure 23).
- Daily cases in the **reference scenario** will decline to under 100,000 by the end of October and then rise slowly to over 130,000 by the end of the year (Figure 24). Daily cases in the **worse scenario** will rise to 435,000 by early December (Figure 24).

- Daily hospital census in the **reference scenario** will decline to 65,000 by the end of October and then rise (Figure 25). Daily hospital census in the **worse scenario** will rise to 277,770 by December 14, 2021 (Figure 25).
- Figure 26 compares our reference scenario forecasts to other publicly archived models. The models mostly agree that deaths will decline slowly during October. The LANL and IHME models suggest increases will come by the end of October or mid-November.
- At some point from September through January 1, 31 states will have high or extreme stress on hospital beds (Figure 27). At some point from September through January 1, 38 states will have high or extreme stress on intensive care unit (ICU) capacity (Figure 28).

Model updates

We have revised the number of reported deaths for Mexican states as well as the Russian Federation away from numbers derived from routine surveillance to those sourced from national cause of death registries. In these two countries, we have seen substantial differences between reported deaths and those assigned to COVID through the death certification review process. Given that deaths recorded in cause of death registries neither span the total time series nor provide daily values, but monthly, we have made the following assumptions to compute a new time series: (a) that the pattern in daily deaths in the cause of death data follows the patterning present in the daily reported series for days within a given month, and (b) that the ratio of monthly reported deaths to monthly deaths registered in cause of death analysis is constant from the last common time period to today. The total excess death estimate is not affected by this change to the reported time series.

Mexico: INEGI: Mortalidad. Conjunto de datos: Defunciones registradas 1990–2020 (resultados preliminares de 2020) https://www.inegi.org.mx/sistemas/olap/proyectos/bd/continuas/mortalidad/mortalidadgeneral.asp?s=est&c=11144&proy=mortgral_mg

Russia: Rosstat: [Natural Population Movement in the Section of Subjects of the Russian Federation] https://rosstat.gov.ru/storage/mediabank/edn07_2021.htm

Figure 1. Daily COVID-19 hospital census and infections

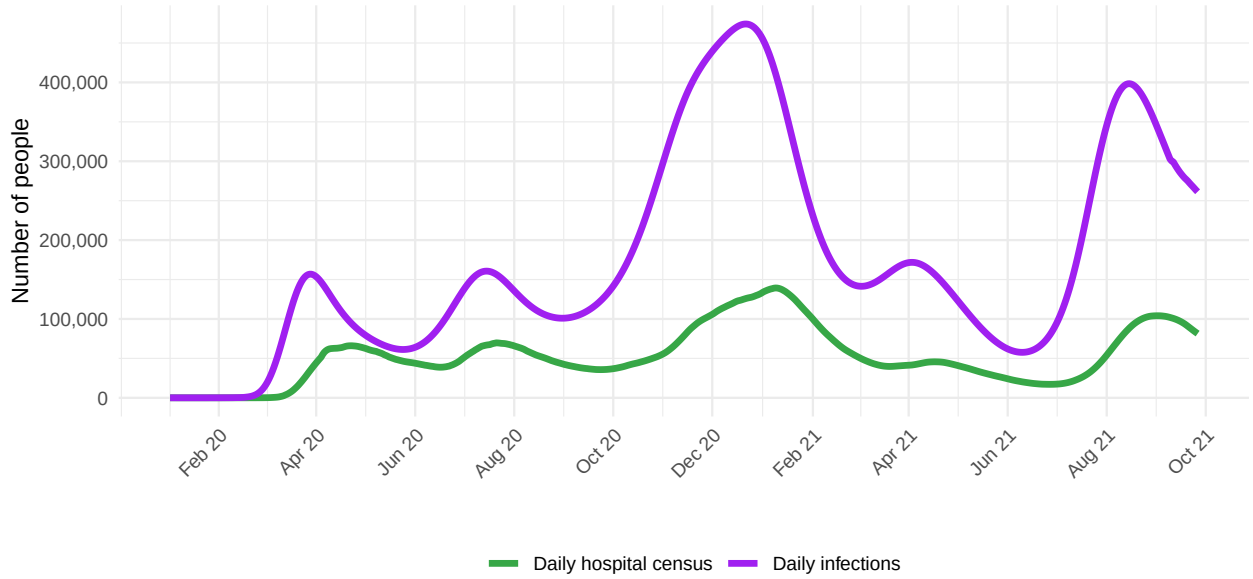


Figure 2. Reported daily COVID-19 cases, moving average

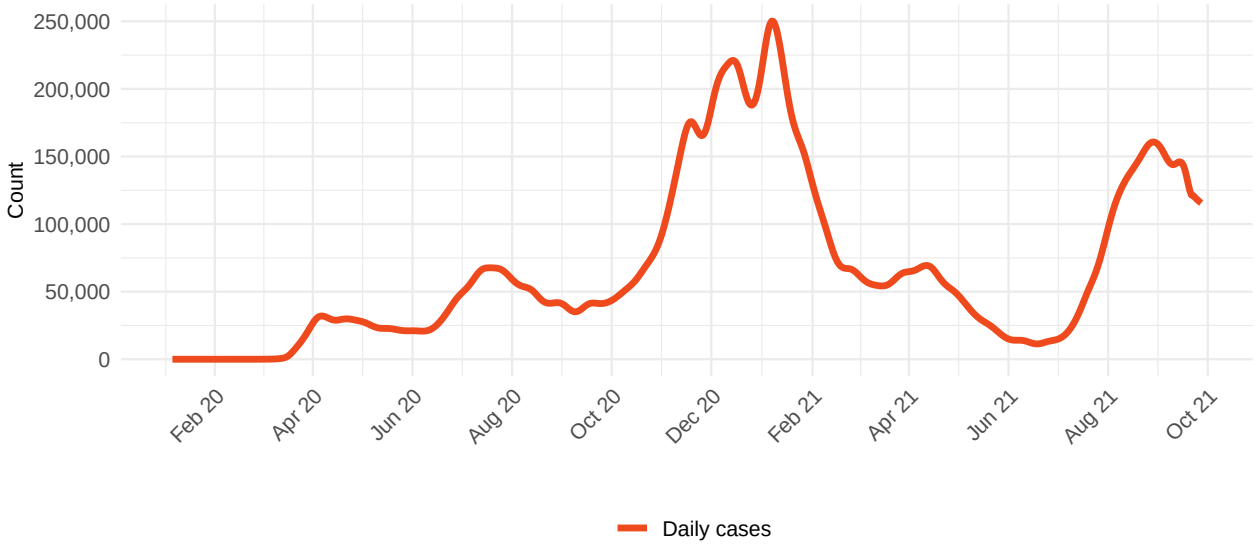


Table 1. Ranking of excess deaths due to COVID-19 among the leading causes of mortality this week, assuming uniform deaths of non-COVID causes throughout the year

Cause name	Weekly deaths	Ranking
COVID-19	20,801	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)

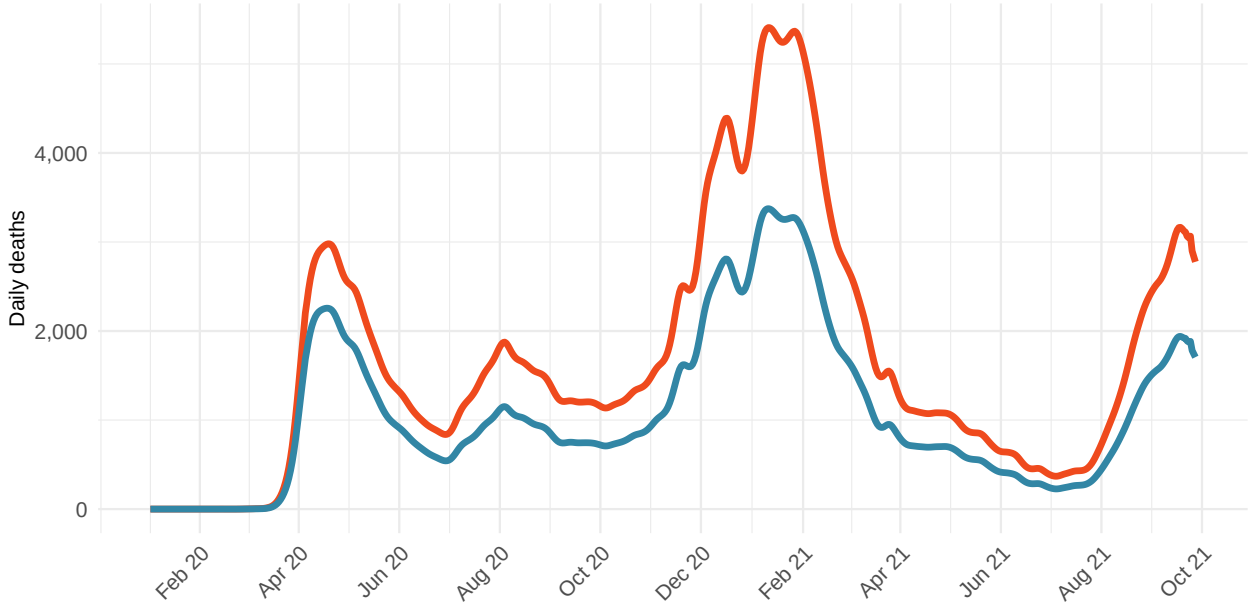
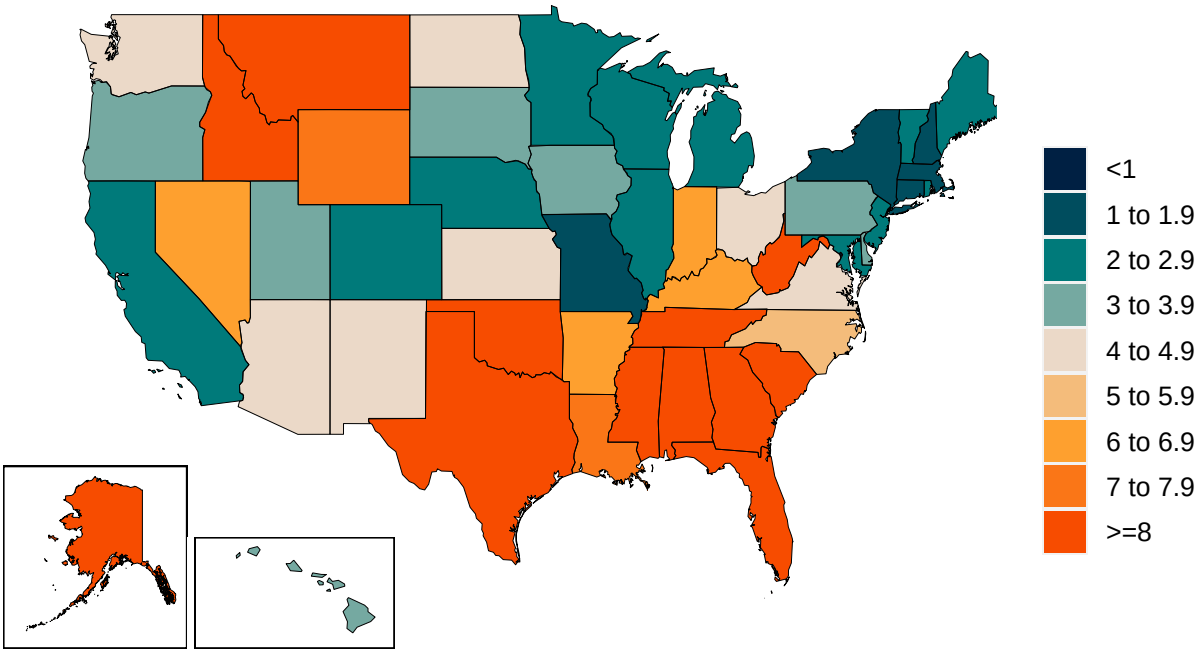


Figure 4. Daily COVID-19 death rate per 1 million on September 27, 2021

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



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

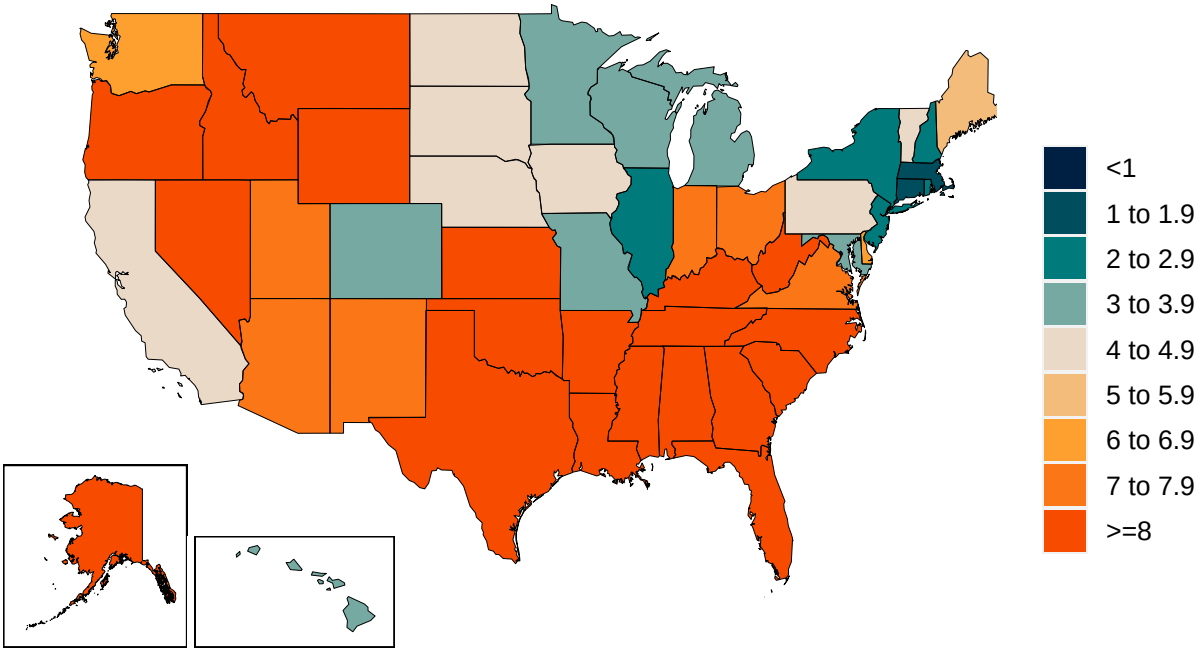
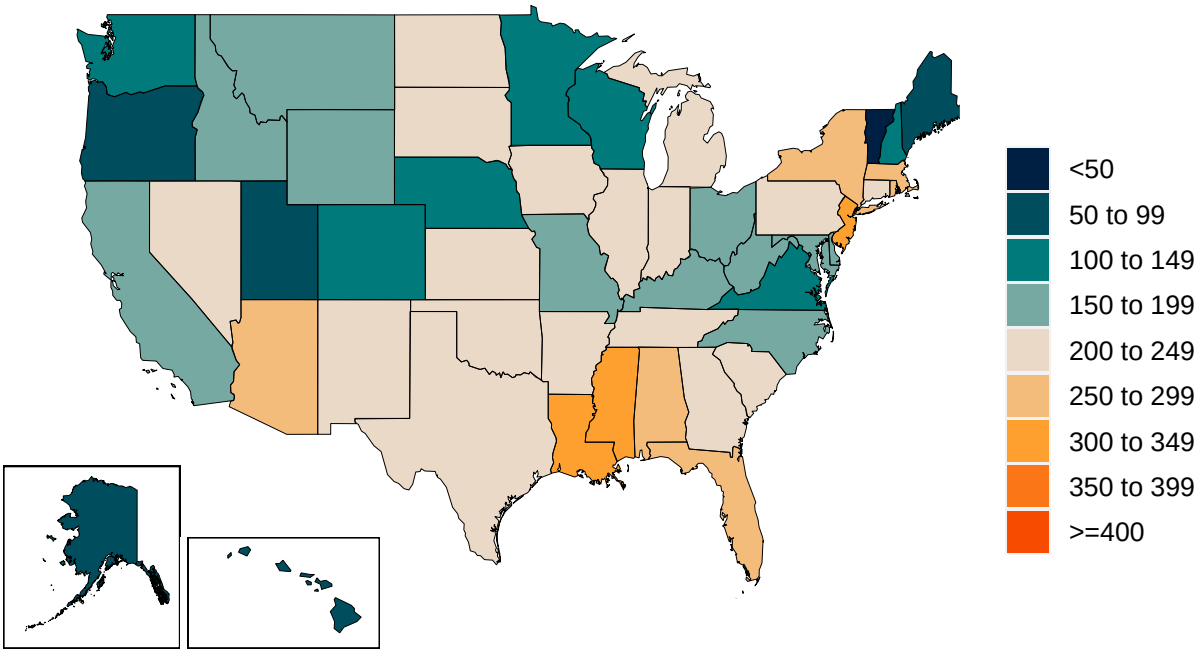


Figure 5. Cumulative COVID-19 deaths per 100,000 on September 27, 2021

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



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

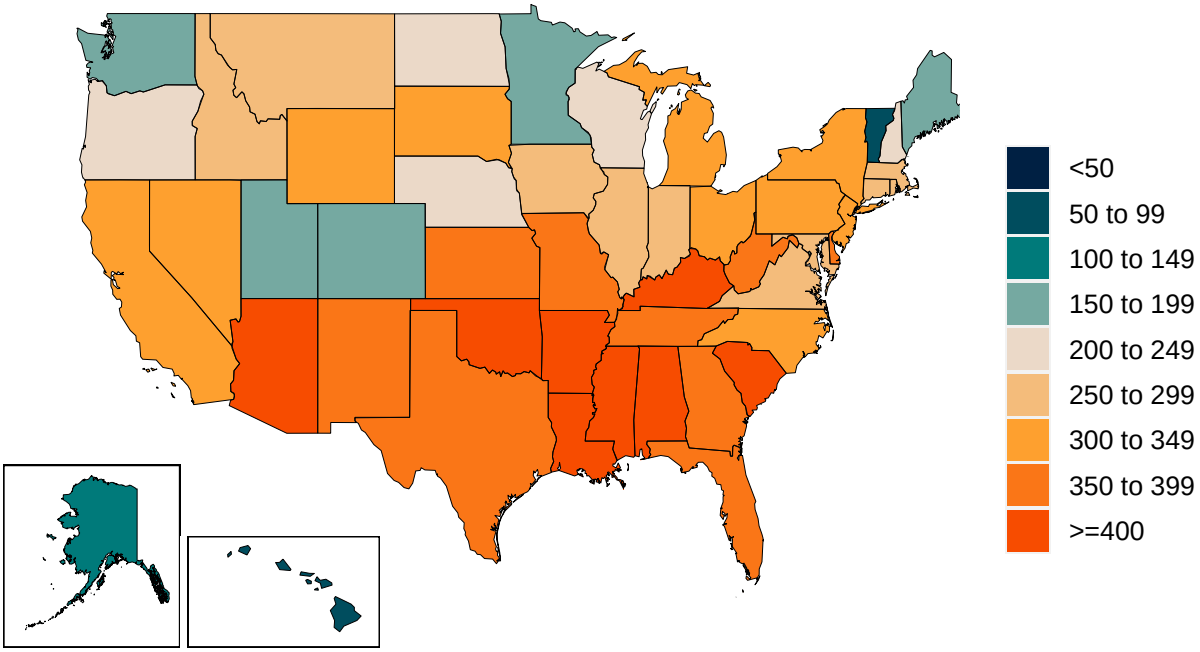


Figure 6. Estimated percent of the population infected with COVID-19 on September 27, 2021

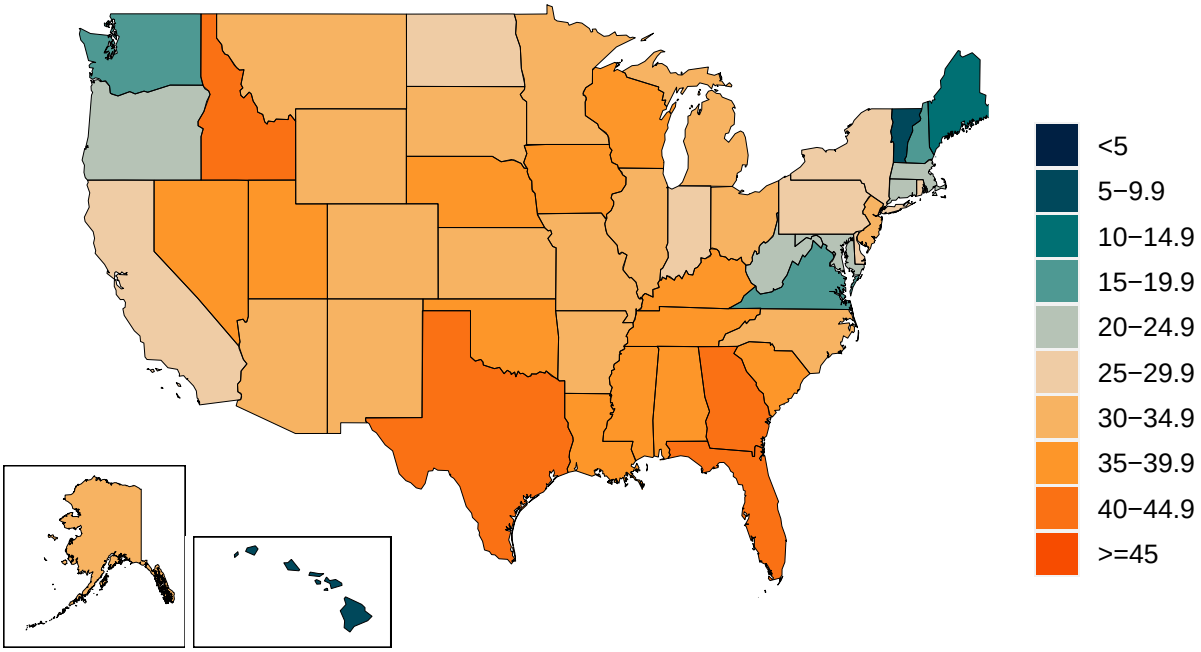


Figure 7. Mean effective R on September 16, 2021. Effective R less than 1 means that transmission should decline, all other things being held the same. The estimate of effective R is based on the combined analysis of deaths, case reporting, and hospitalizations where available. Current reported cases reflect infections 11-13 days prior, so estimates of effective R can only be made for the recent past.

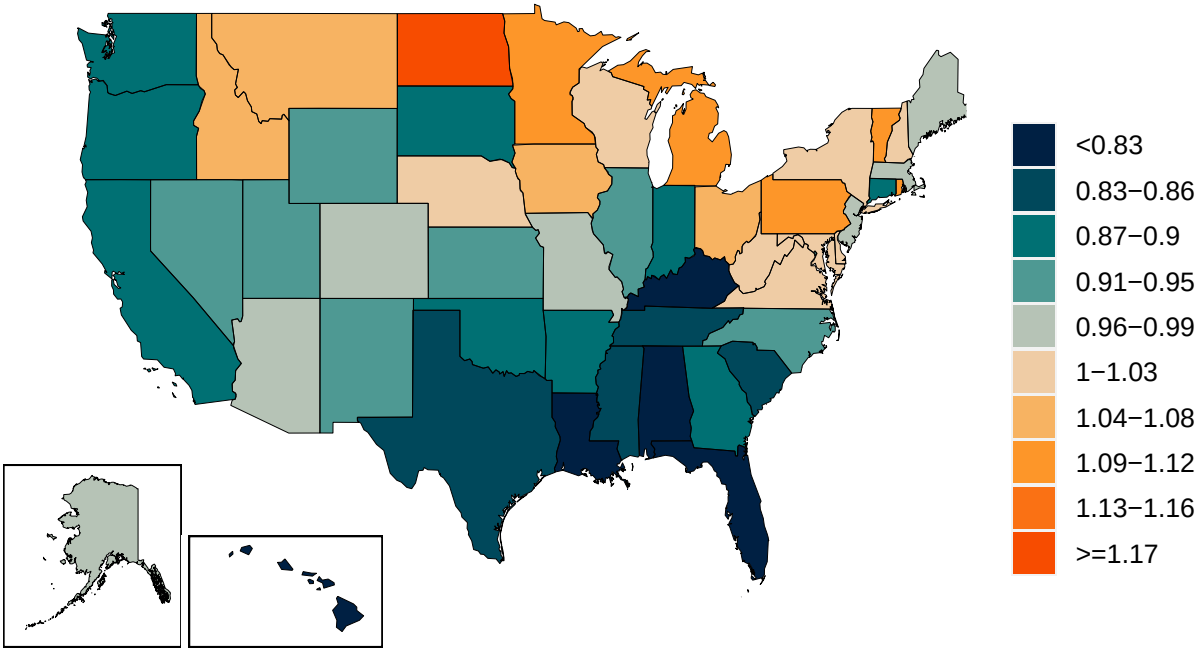


Figure 8. Percent of COVID-19 infections detected. This is estimated as the ratio of reported daily COVID-19 cases to estimated daily COVID-19 infections based on the SEIR disease transmission model. Due to measurement errors in cases and testing rates, the infection-detection rate can exceed 100% at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

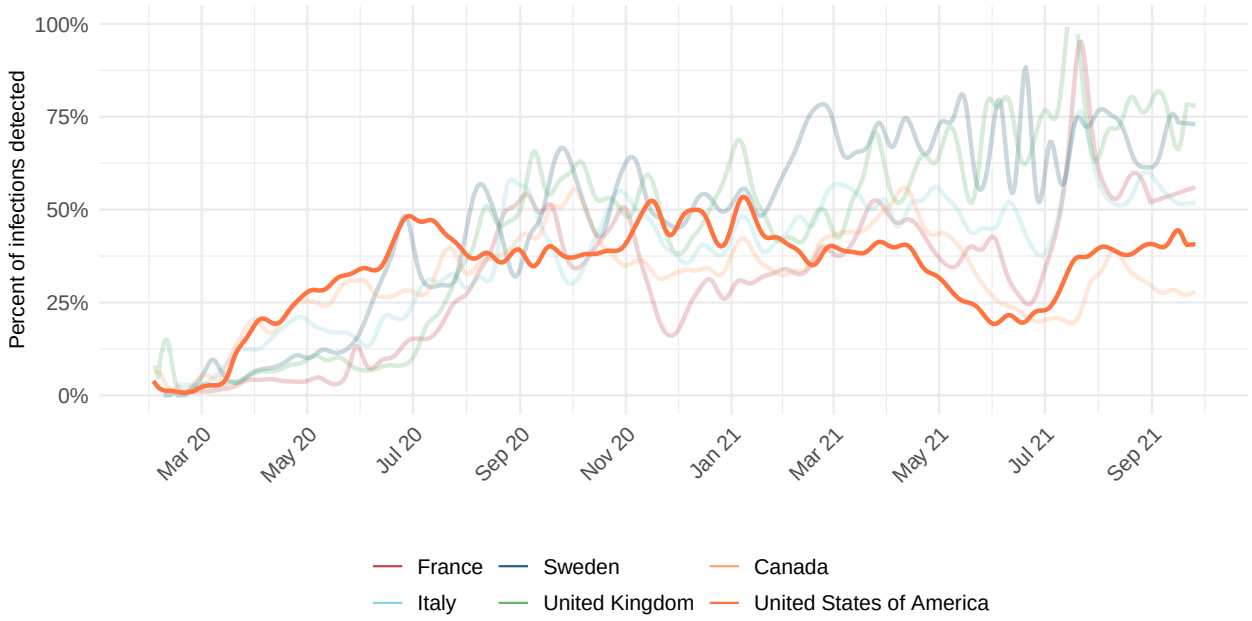
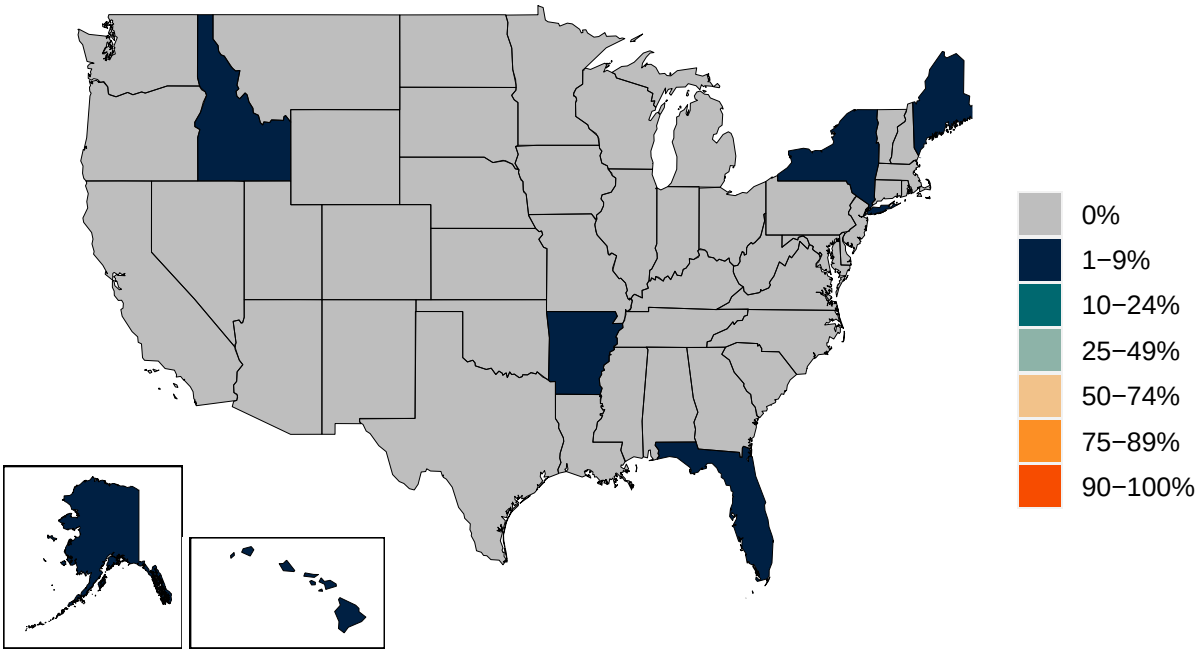
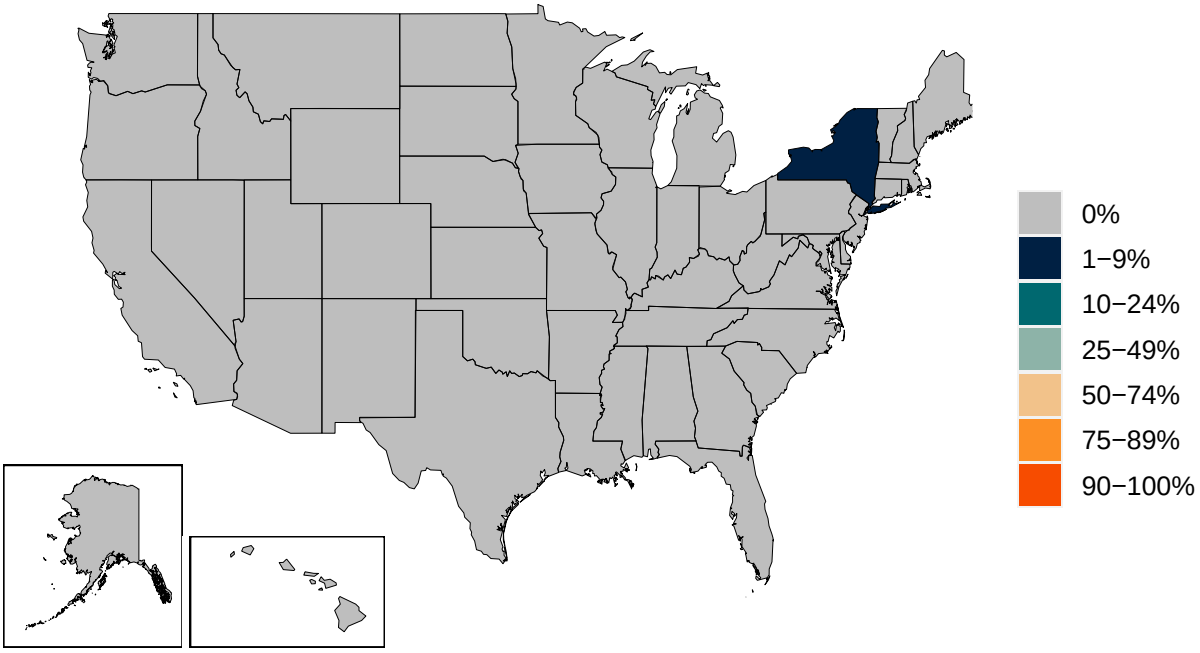


Figure 9. Estimated percent of circulating SARS-CoV-2 for primary variant families on September 27, 2021

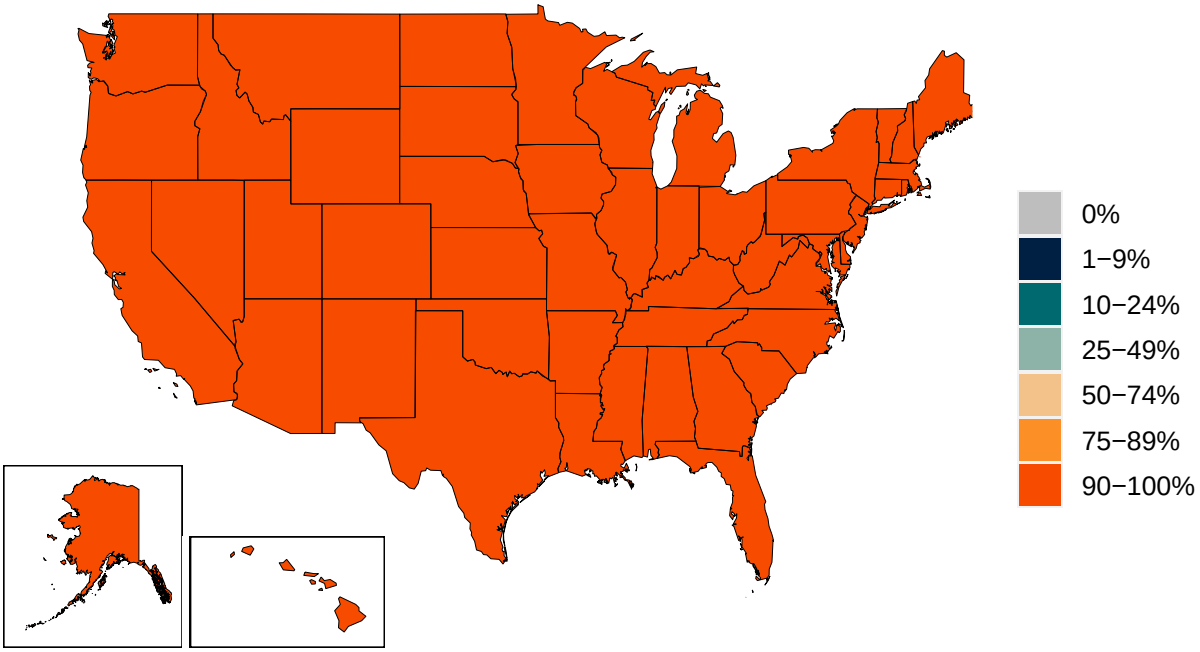
A. Estimated percent Alpha variant



B. Estimated percent Beta variant



C. Estimated percent Delta variant



D. Estimated percent Gamma variant

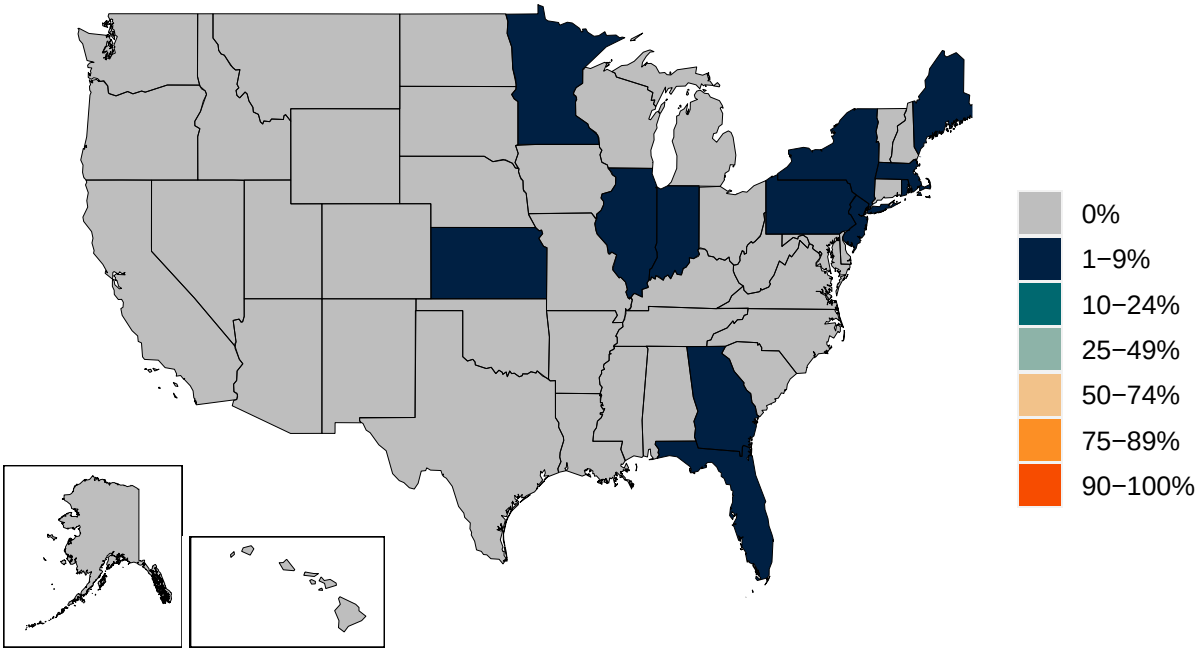
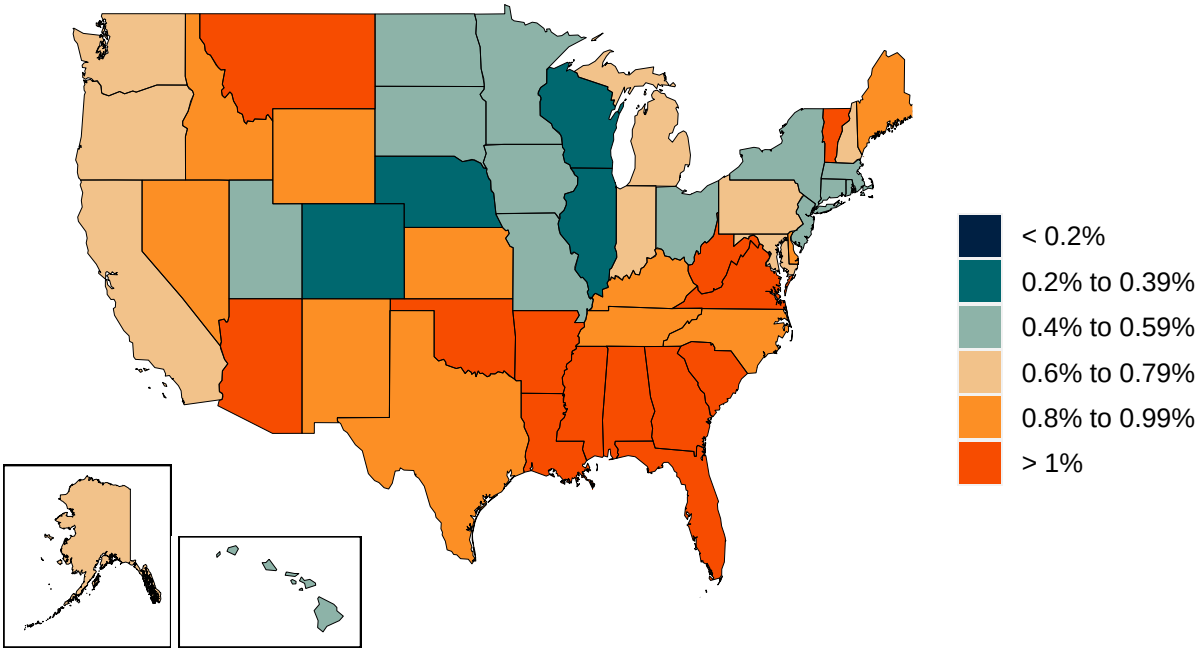


Figure 10. Infection-fatality rate on September 27, 2021. This is estimated as the ratio of COVID-19 deaths to estimated daily COVID-19 infections.



Critical drivers

Table 2. Current mandate implementation

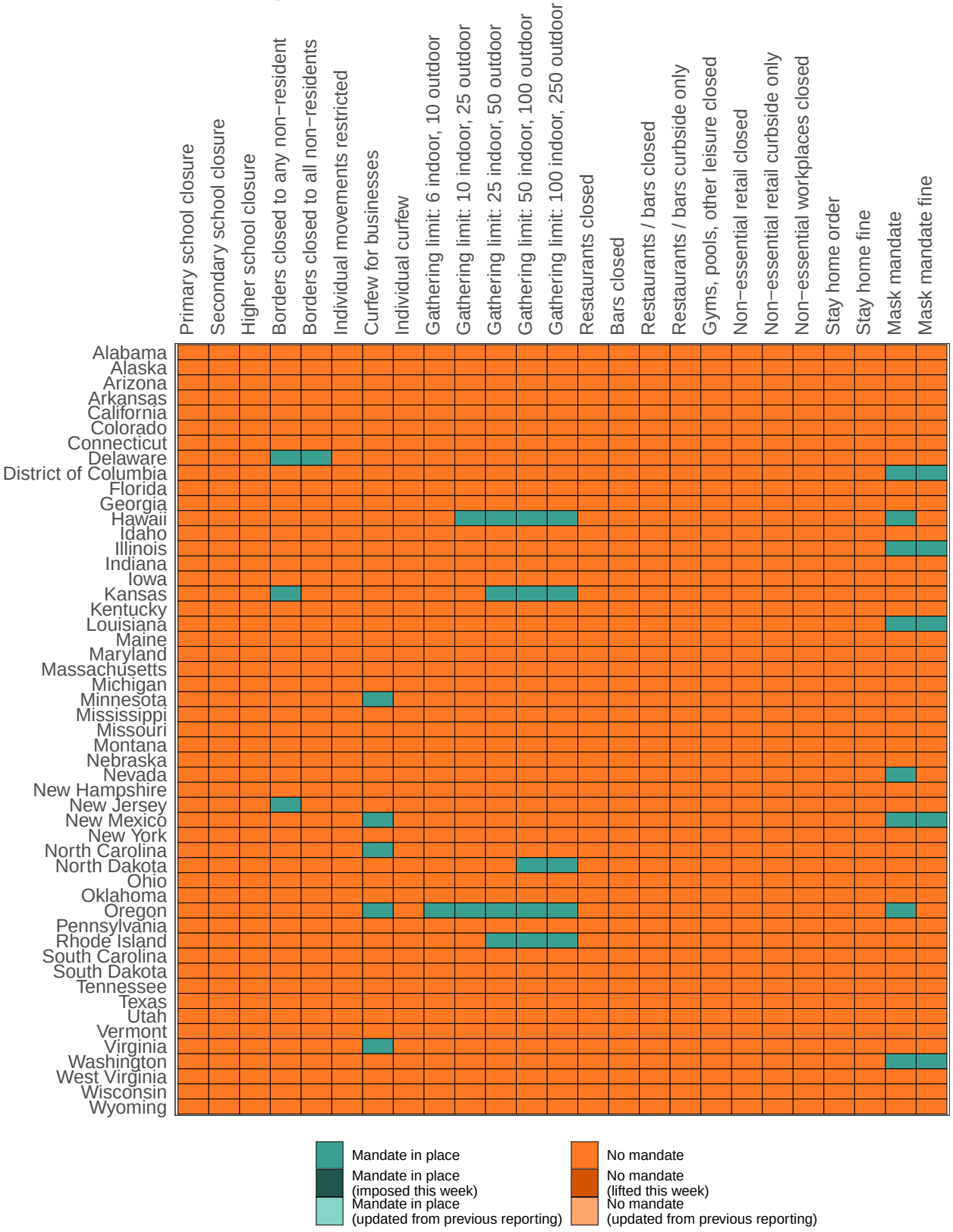


Figure 11. Trend in mobility as measured through smartphone app use, compared to January 2020 baseline

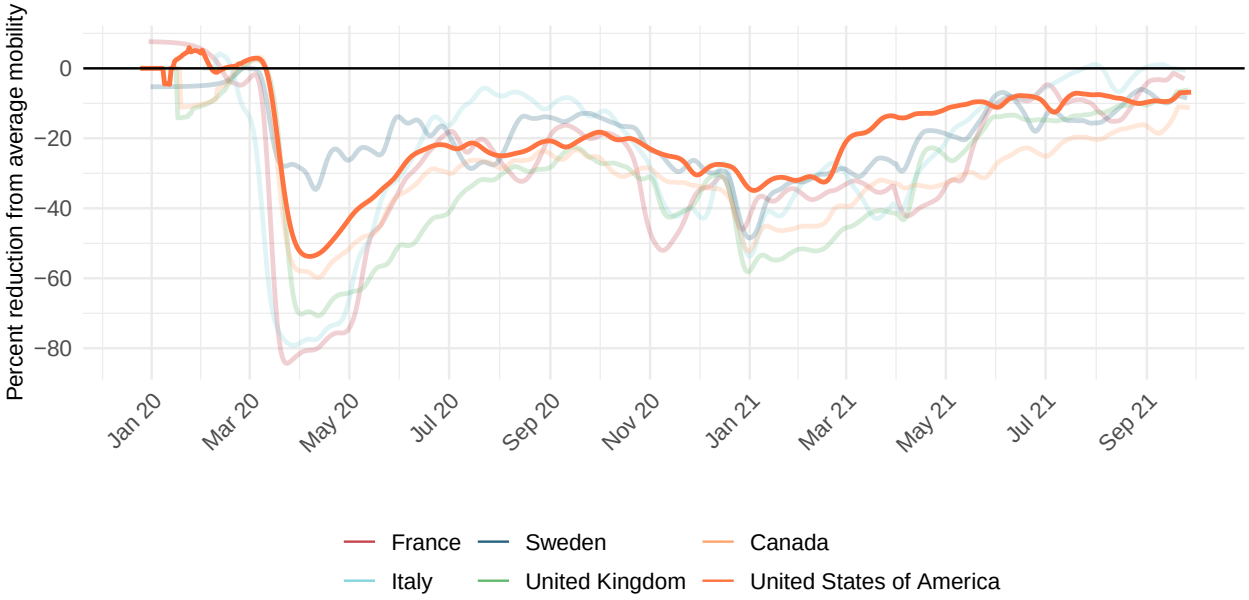


Figure 12. Mobility level as measured through smartphone app use, compared to January 2020 baseline (percent) on September 27, 2021

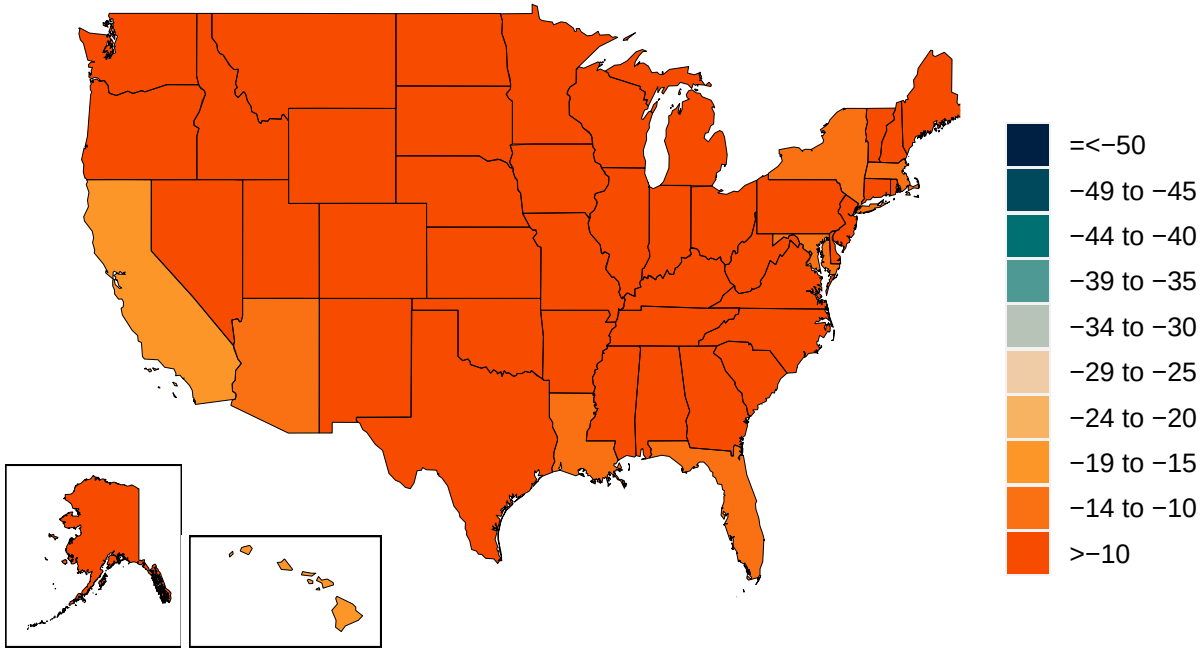


Figure 13. Trend in the proportion of the population reporting always wearing a mask when leaving home

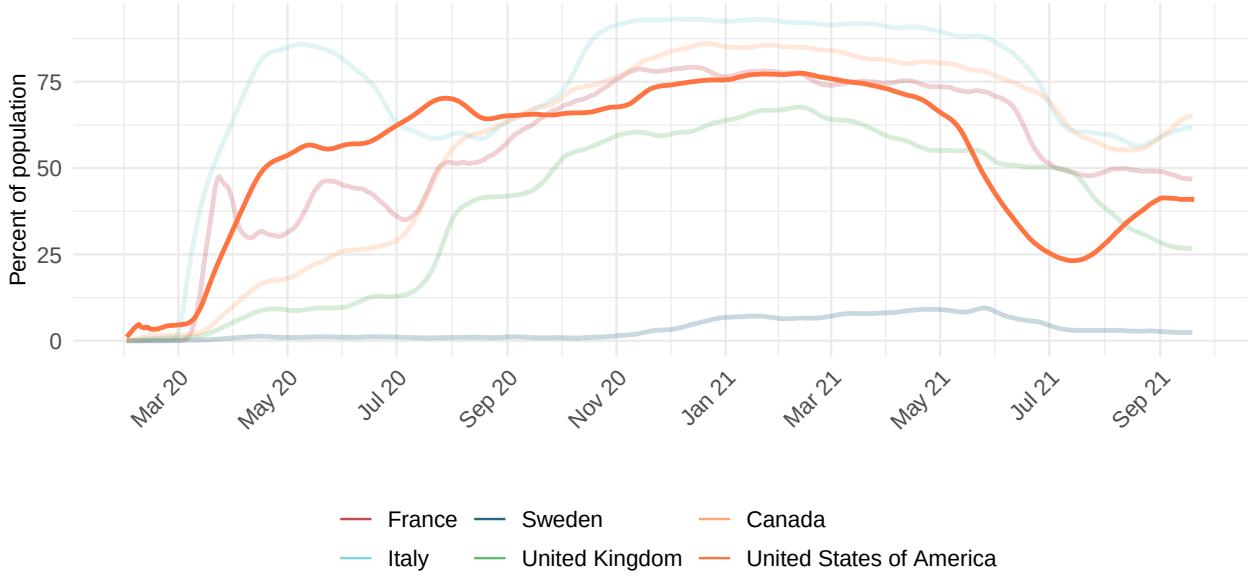


Figure 14. Proportion of the population reporting always wearing a mask when leaving home on September 27, 2021

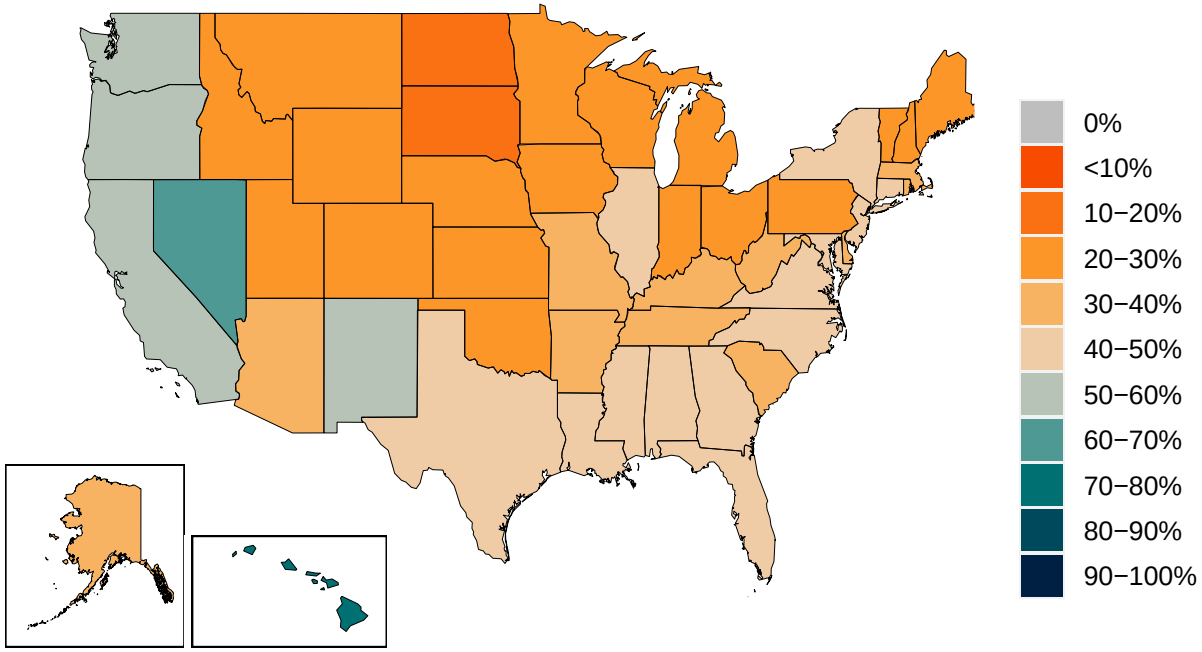


Figure 15. Trend in COVID-19 diagnostic tests per 100,000 people

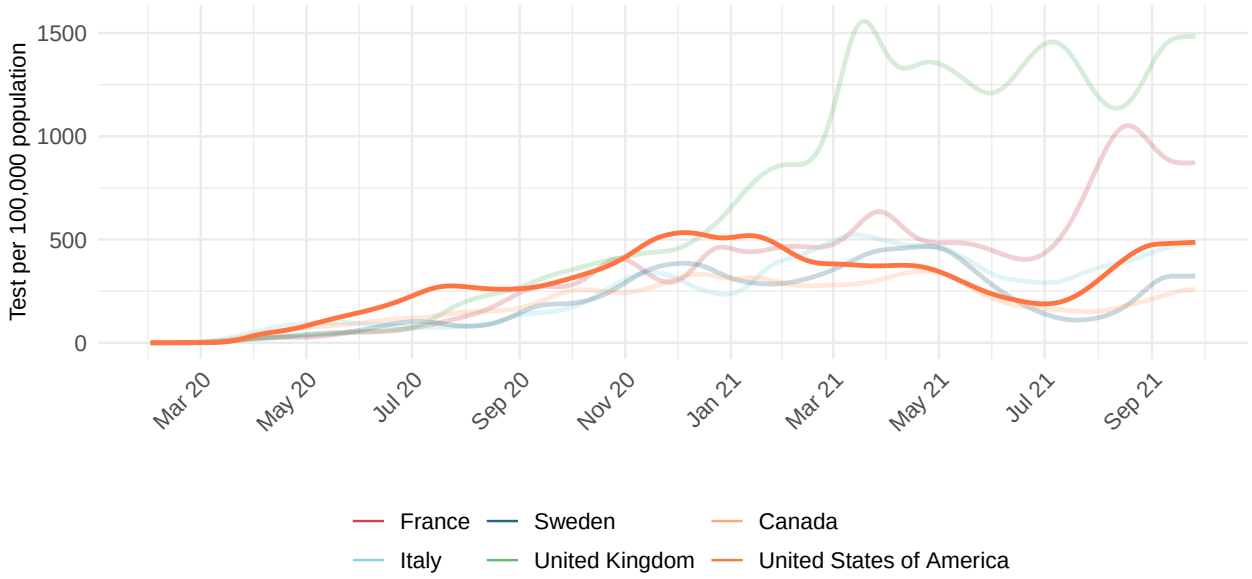


Figure 16. COVID-19 diagnostic tests per 100,000 people on September 27, 2021

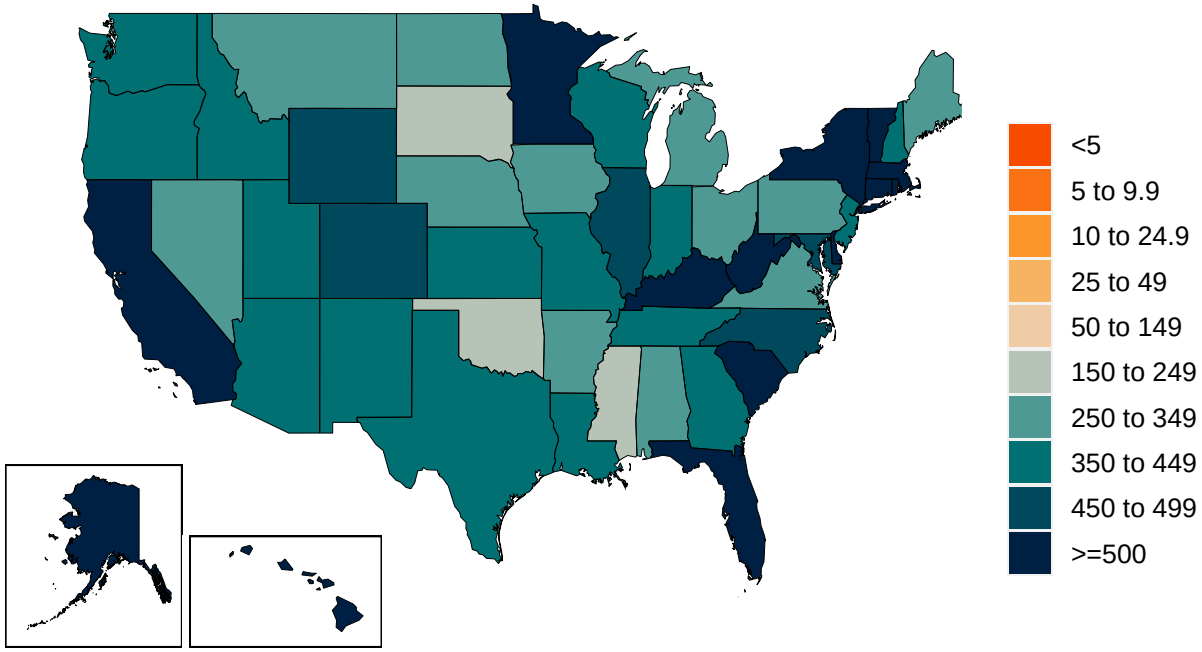
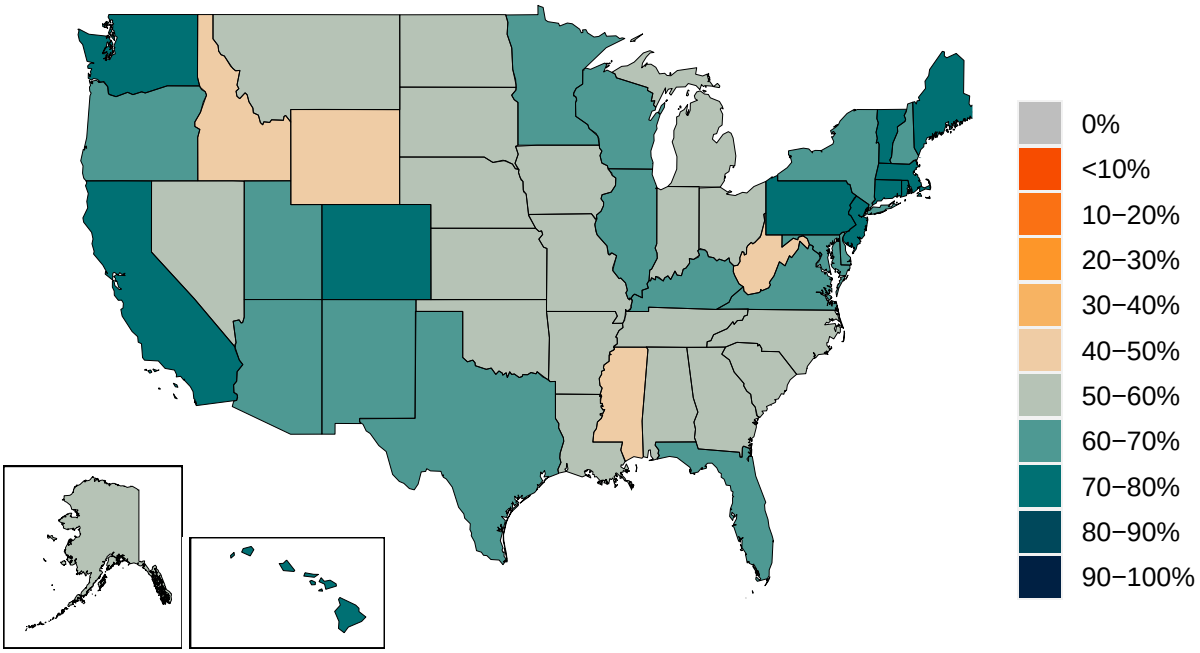


Table 3. Estimates of vaccine efficacy for specific vaccines used in the model at preventing disease and infection. The SEIR model uses variant-specific estimates of vaccine efficacy at preventing symptomatic disease and at preventing infection. We use data from clinical trials directly, where available, 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 CanSino	66%	58%	57%	50%
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 27, 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

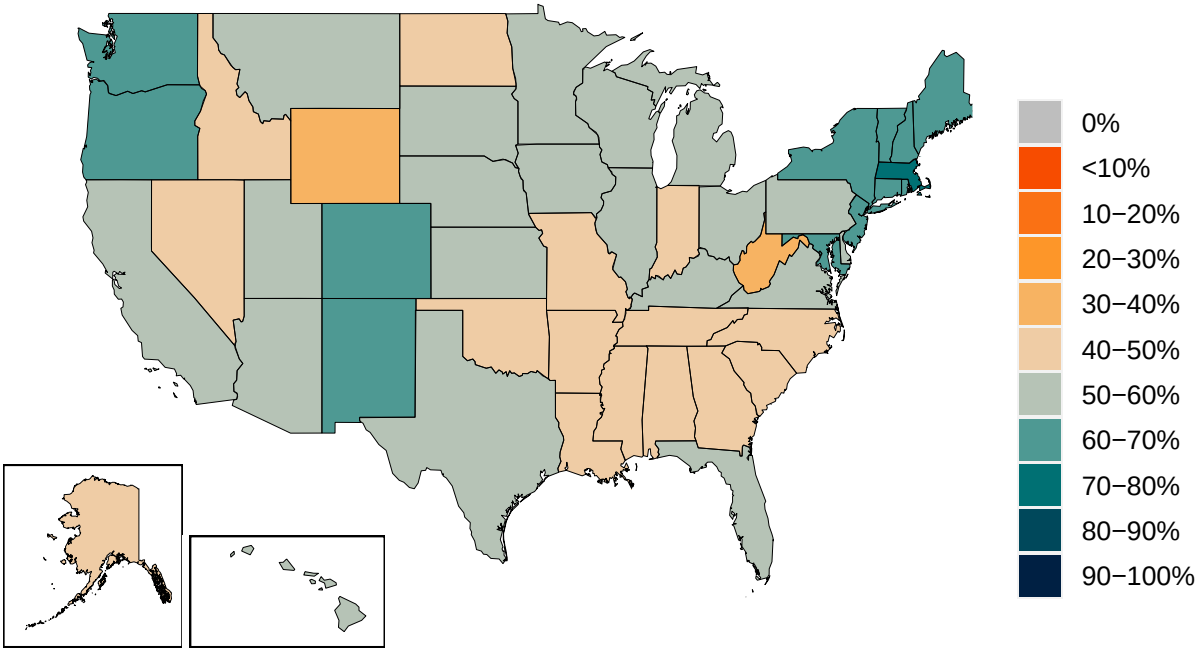


Figure 18. Trend in the estimated proportion of the population that is 12 years and older that has been vaccinated or would probably or definitely receive the COVID-19 vaccine if available. Note that vaccine acceptance is calculated using survey data from the 18+ population.

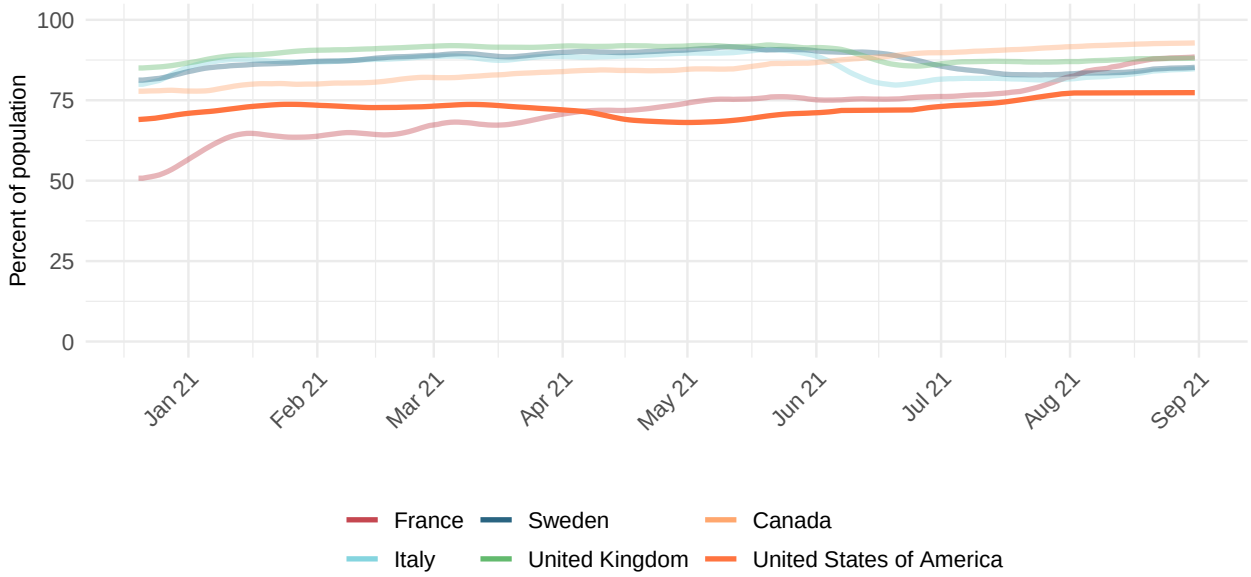


Figure 19. Estimated proportion of the population that is 12 years and older that has been vaccinated or would probably or definitely receive the COVID-19 vaccine if available. Note that vaccine acceptance is calculated using survey data from the 18+ population.

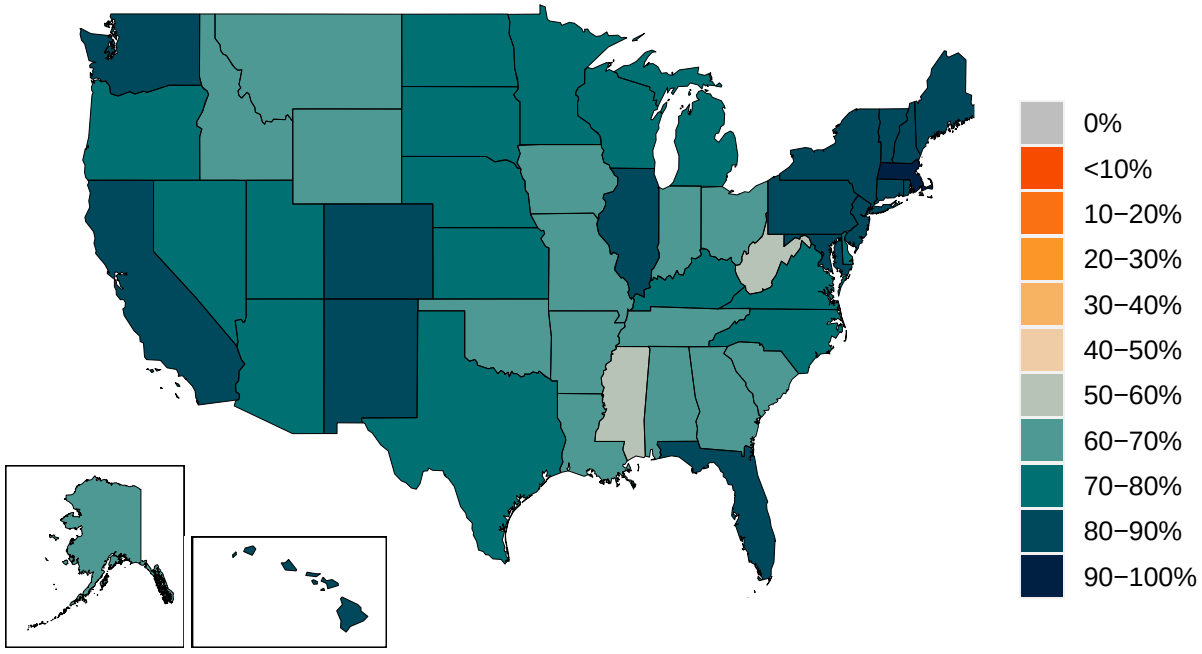


Figure 20. Percent of people who receive at least one dose of a COVID-19 vaccine and those who are fully vaccinated

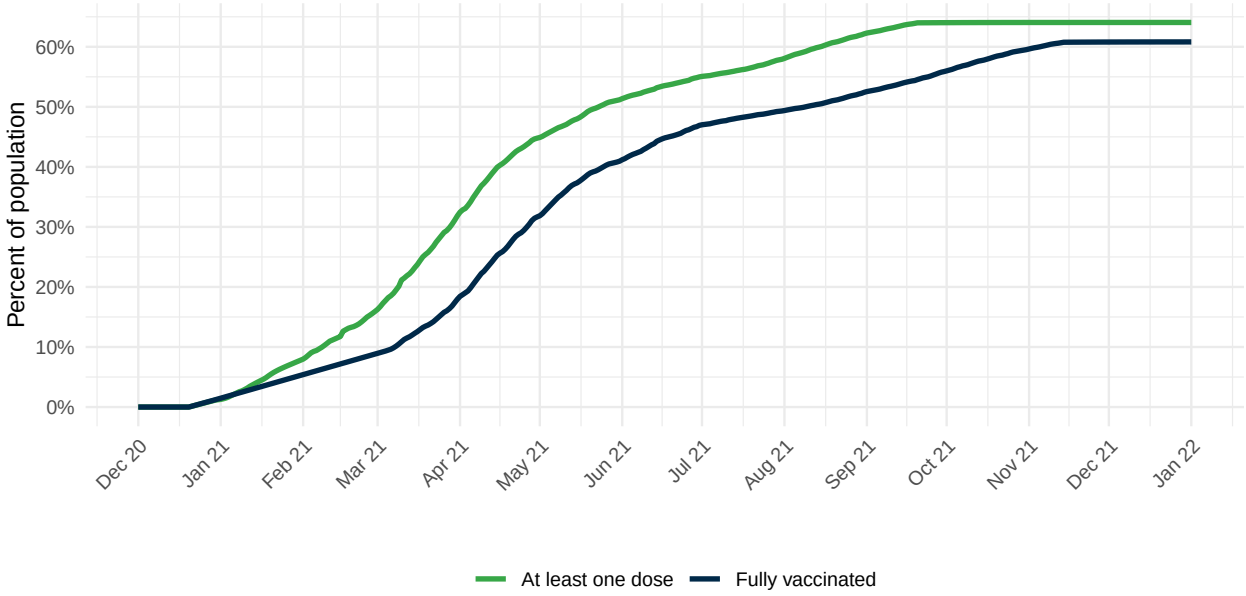
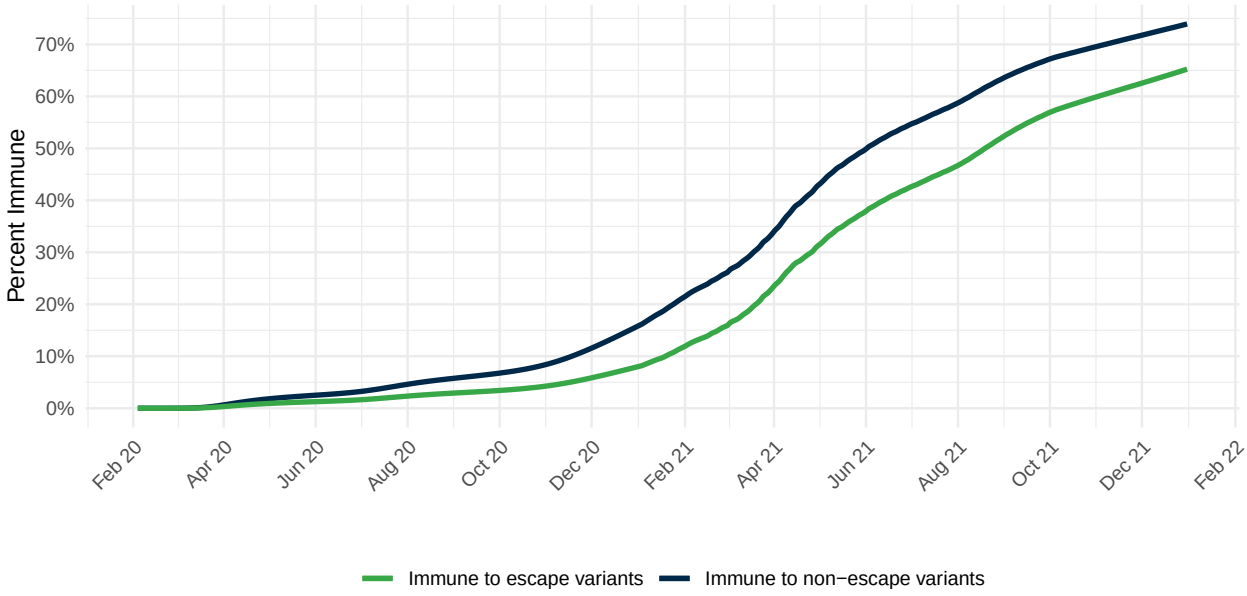


Figure 21. Percentage of people who are immune to non-escape variants and the percentage of people who are immune to escape variants



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.

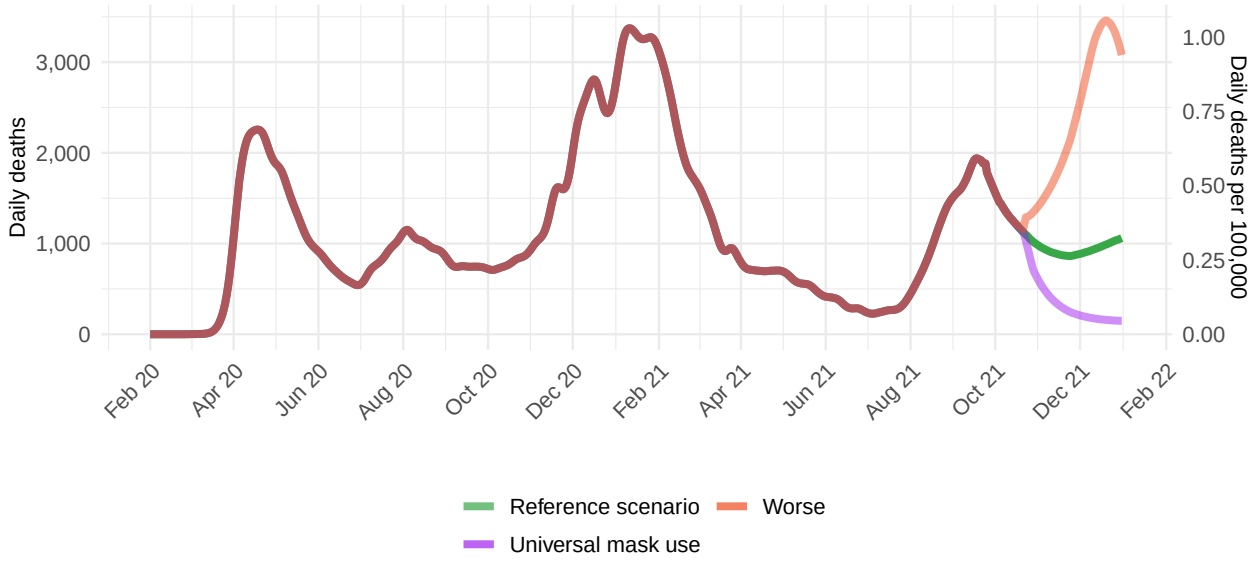
The **worse scenario** modifies the reference scenario assumption in four ways:

- 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

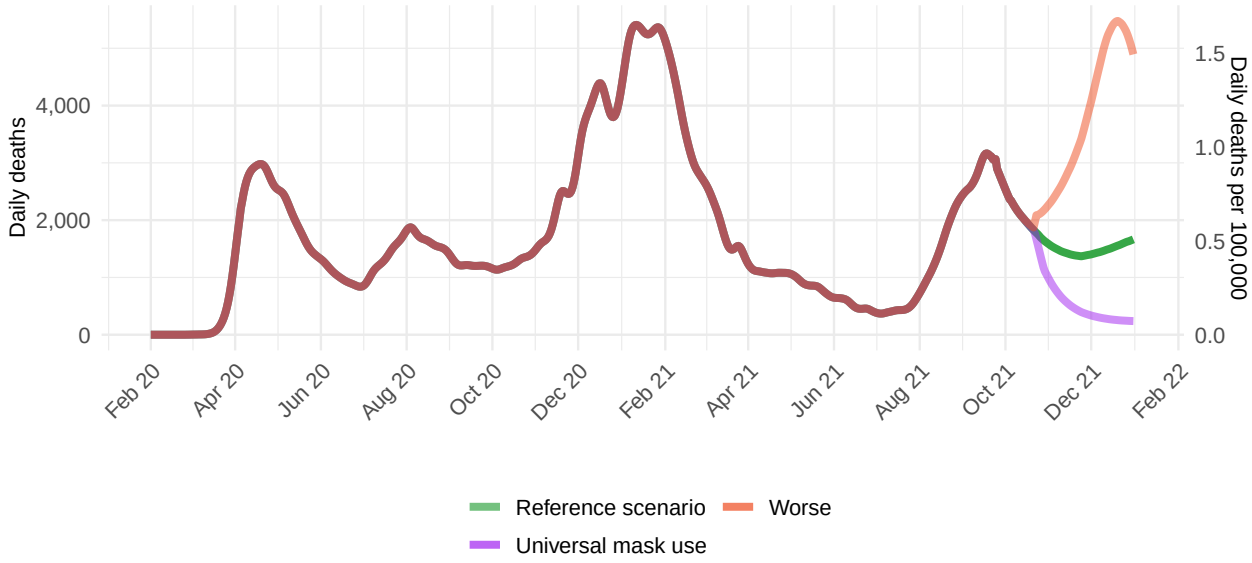


Figure 23. Daily COVID-19 infections until January 01, 2022 for three scenarios

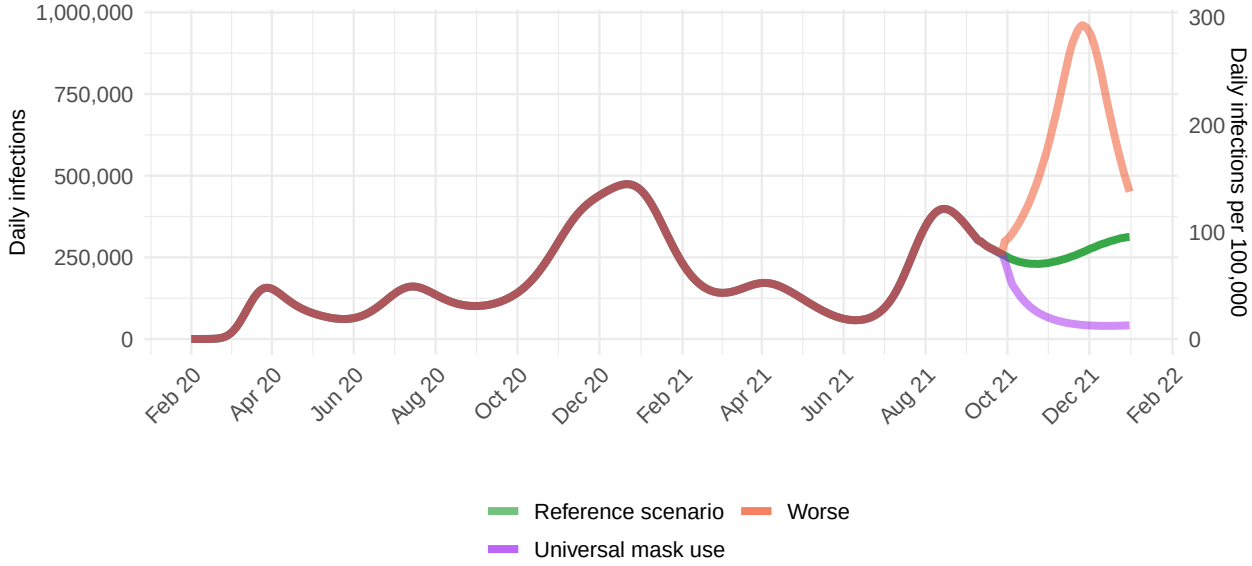


Figure 24. Daily COVID-19 reported cases until January 01, 2022 for three scenarios

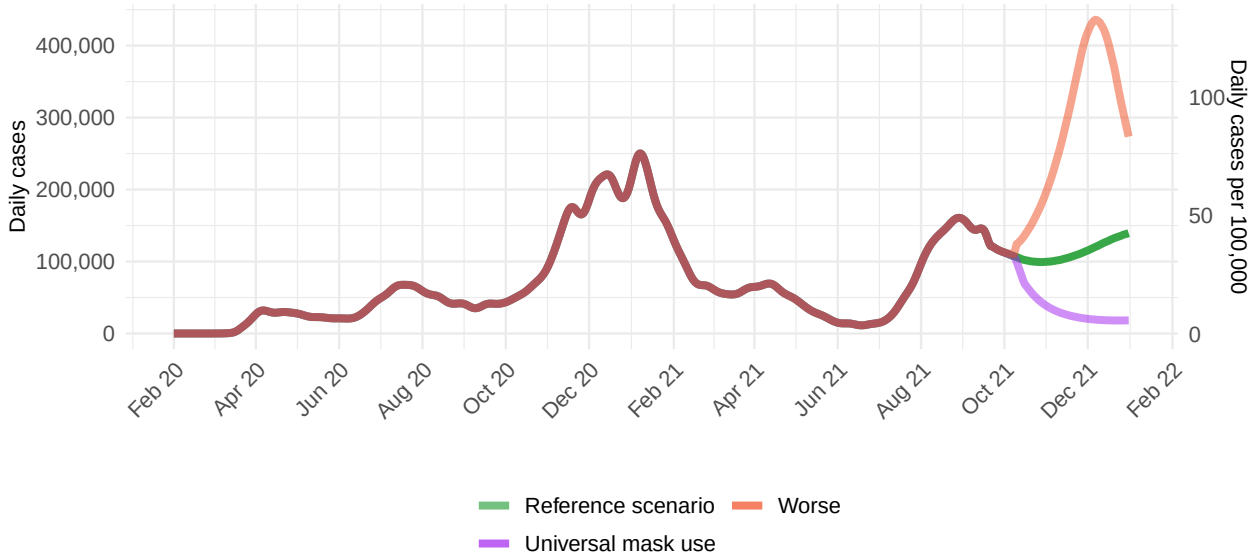


Figure 25. Daily COVID-19 hospital census until January 01, 2022 for three scenarios

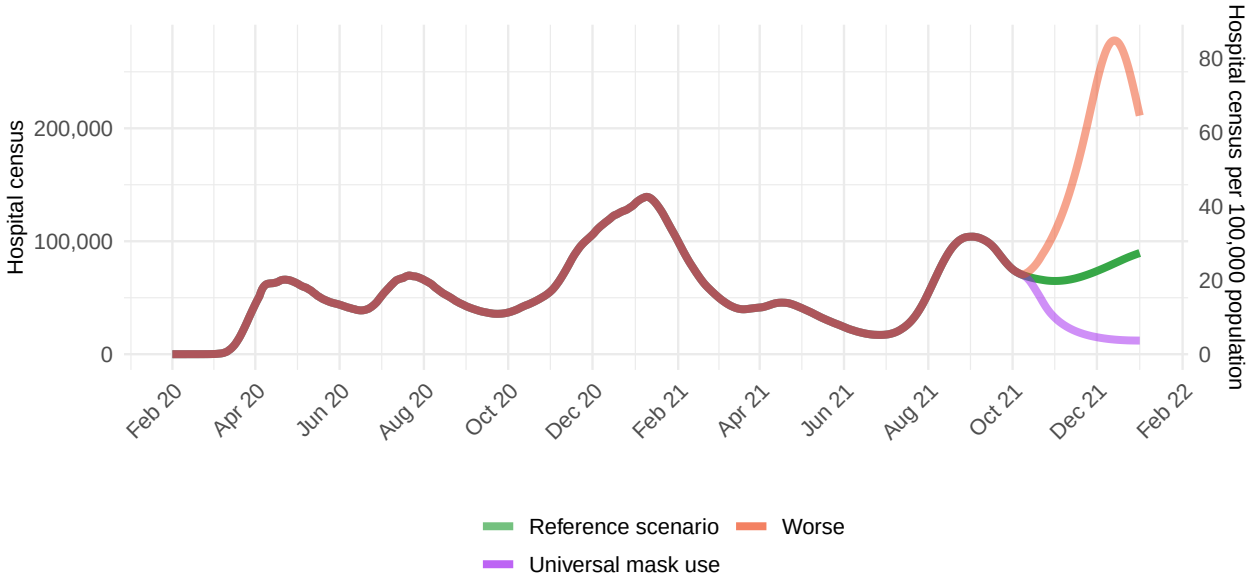


Figure 26. Comparison of reference model projections with other COVID modeling groups. For this comparison, we are including projections of daily COVID-19 deaths from other modeling groups when available, last model update in brackets: Delphi from the Massachusetts Institute of Technology (Delphi) [September 22, 2021], Imperial College London (Imperial) [September 9, 2021], The Los Alamos National Laboratory (LANL) [September 19, 2021], the SI-KJalpha model from the University of Southern California (SIKJalpha) [September 22, 2021], and the CDC Ensemble Model (CDC) [September 20, 2021]. Daily deaths from other modeling groups are smoothed to remove inconsistencies with rounding. Regional values are aggregates from available locations in that region.

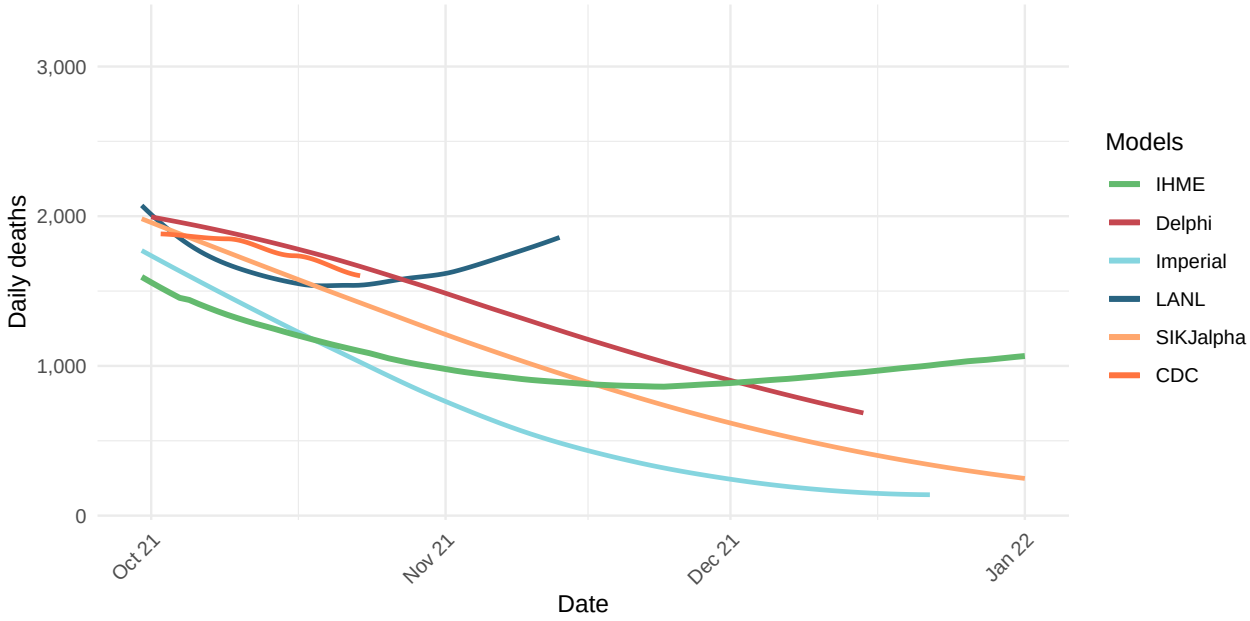


Figure 27. The estimated inpatient hospital usage is shown over time. The percent of hospital beds occupied by COVID-19 patients is color-coded based on observed quantiles of the maximum proportion of beds occupied by COVID-19 patients. Less than 5% is considered *low stress*, 5-9% is considered *moderate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

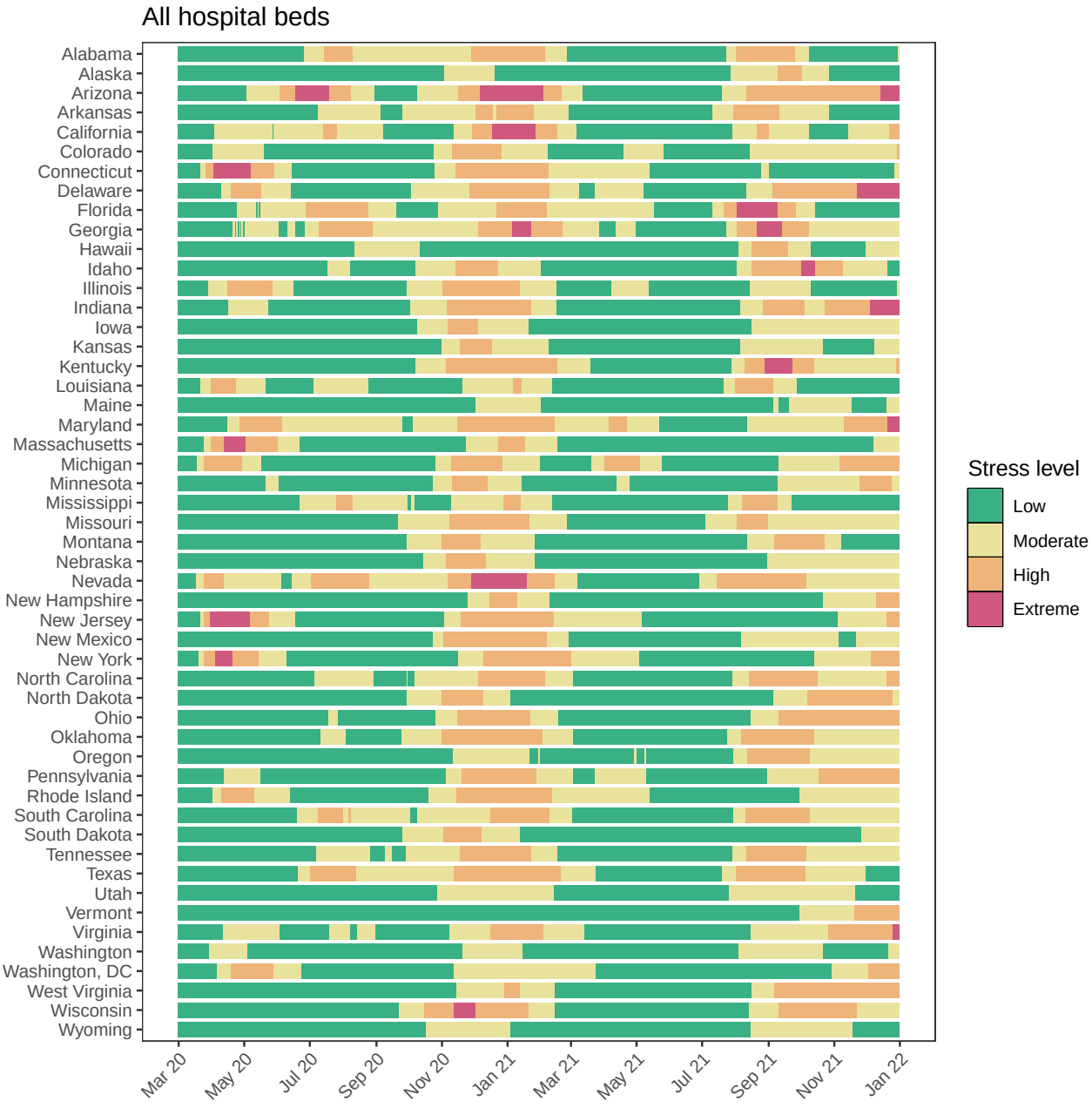
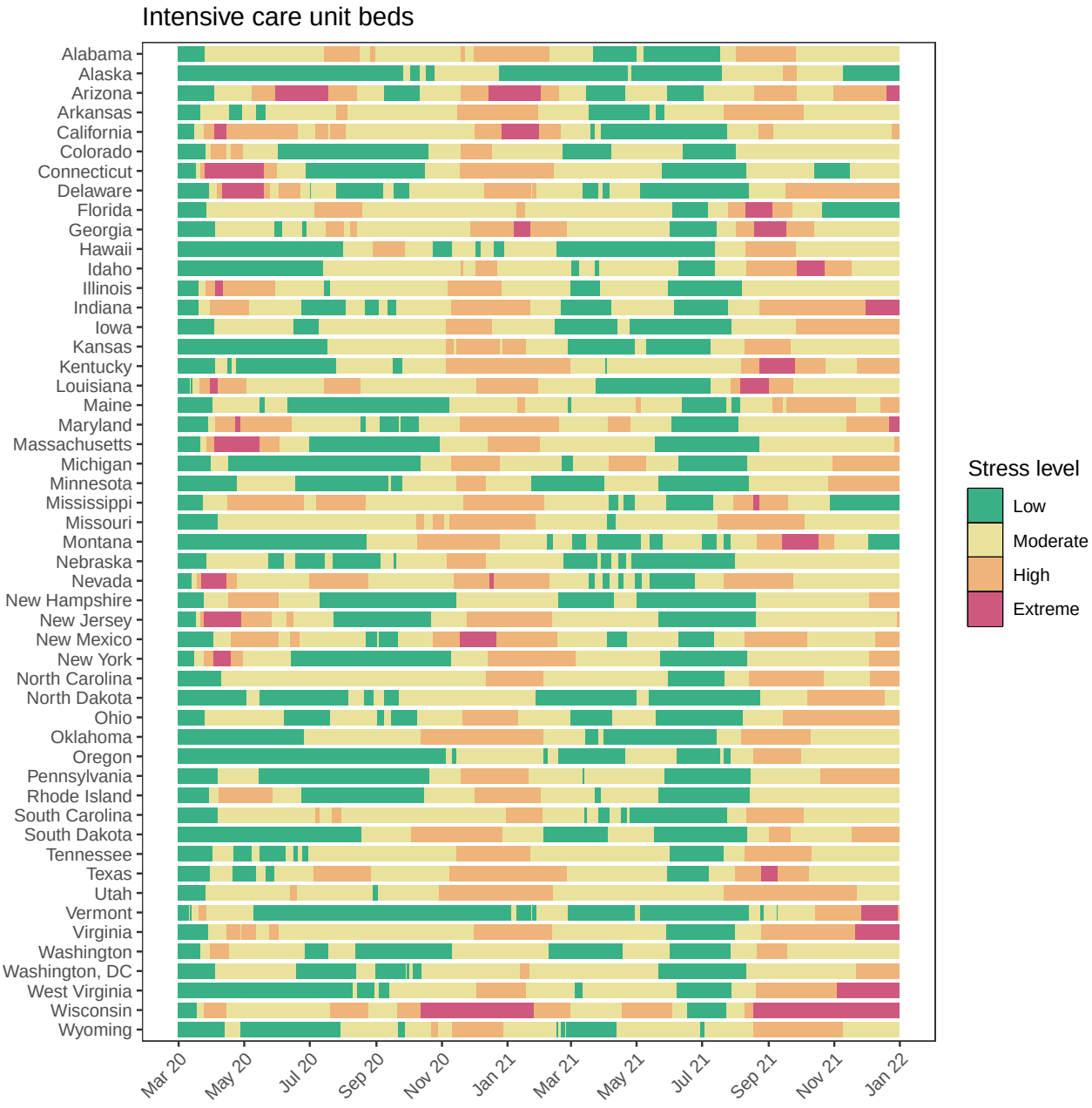


Figure 28. The estimated intensive care unit (ICU) usage is shown over time. The percent of ICU beds occupied by COVID-19 patients is color-coded based on observed quantiles of the maximum proportion of ICU beds occupied by COVID-19 patients. Less than 10% is considered *low stress*, 10-29% is considered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