COVID-19 Results Briefing

The United States of America

May 27, 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 May 26, 2021, with data through May 24, 2021.

At the national level, cases and deaths continue to decline, driven by rising vaccination rates and declining seasonality. In three states hospitalizations are increasing – New Mexico, Arkansas, and Mississippi – but cases and deaths have not increased to the same degree. The P.1 variant is present in a number of states and starting to replace the B.1.1.7 variant. It is possible that the P.1 variant could lead to rising cases and deaths later in the summer in some US states, depending on the trajectory of vaccination, or the surge from this variant may be delayed into the fall due to seasonality. Daily vaccinations continue to decline so that we expect the US will reach a maximum of 170 million fully vaccinated adults by July. This would mean that 30% of adults will go unvaccinated, plus a substantial fraction of children who will go unvaccinated. This group, combined with one-quarter of those vaccinated with mRNA vaccines still susceptible to infection with escape variants, will mean more than 50% of the population will be capable of sustaining transmission later in the fall and winter. Our forecasts suggest continued declines in cases and deaths in June and July and into August. The main strategies to minimize a surge next fall/winter are increasing vaccination rates and preparing the public for the potential need to wear masks when transmission begins to increase again.

Current situation

- Daily reported cases in the last week decreased to 25,500 per day on average compared to 33,300 the week before (Figure 1). This continues the decline that began in mid-April.
- Daily deaths, corrected for under-reporting, in the last week decreased to 740 per day on average compared to 890 the week before (Figure 2). Total daily COVID-19 deaths were 1.6 times larger than the reported number of deaths. This makes COVID-19 the number 2 cause of death in the United States of America this week (Table 1).
- The daily death rate is greater than 4 per million in Kentucky and Michigan (Figure 3).
- We estimated that 35% of people in the US have been infected as of May 24 (Figure 5).
- Effective R, computed using cases, hospitalizations, and deaths, is greater than 1 in Arkansas and Mississippi (Figure 6).
- The infection-detection rate in the US was close to 24% on May 24 (Figure 7).
- In the US, we estimate that the primary circulating variants are B.1.1.7 variants. P.1 is circulating and increasing in at least six states.

Trends in drivers of transmission

- Some mandates have been lifted in Colorado, Delaware, the District of Columbia, Illinois, Maine, Michigan, New Mexico, New York, North Dakota, Ohio, Rhode Island, Vermont, Virginia, Washington, and West Virginia.
- Mobility last week was 16% lower than the pre-COVID-19 baseline (Figure 10). Mobility was near baseline (within 10%) in 22 states. Mobility was lower than 30% of baseline in Massachusetts and the District of Columbia.
- As of May 24, in Facebook surveys 58% of people self-reported that they always wore a mask when leaving their home (Figure 12). Mask use was lower than 50% in Alabama, Alaska, Arkansas, Idaho, Iowa, Kansas, Louisiana, Mississippi, Missouri, Montana, Nebraska, North Dakota, Oklahoma, South Carolina, South Dakota, Tennessee, Utah, Wisconsin, and Wyoming.
- There were 363 diagnostic tests per 100,000 people on May 24 (Figure 14).
- In the US, 69.4% of people say they would accept or would probably accept a vaccine for COVID-19. The fraction of the population who are open to receiving a COVID-19 vaccine ranges from 55% in Wyoming to 80% in the District of Columbia (Figure 18).
- In our current reference scenario, we expect that 173 million people will be vaccinated by September 1 (Figure 19). Vaccination rates are declining due to limited demand rather than supply constraints.

Projections

- In our **reference scenario**, which represents what we think is most likely to happen, our model projects 953,000 cumulative deaths on September 1, 2021. This represents 27,000 additional deaths from May 24 to September 1 (Figure 20). Daily deaths are expected to decline steadily until September 1 (Figure 21).
- If **universal mask coverage (95%)** were attained in the next week, our model projects 9,200 fewer cumulative deaths compared to the reference scenario on September 1, 2021 (Figure 20).
- Under our **worse scenario**, our model projects 963,000 cumulative deaths on September 1, 2021, an additional 10,000 deaths compared to our reference scenario (Figure 20).
- By September 1, we project that 8,500 lives will be saved by the projected vaccine rollout. This does not include the lives saved from vaccinations that have already been delivered.
- Daily infections in the reference scenario drop steadily until late August. In the worse scenario, due to the spread of escape variants, infections begin rising in late July (Figure 22).

- Figure 23 compares our reference scenario forecasts to other publicly archived models. All the publicly archived models suggest that daily deaths will decline steadily with the exception of the Los Alamos National Labs model, which forecasts an increase beginning in late June.
- At some point from May through September 1, 10 states will have high or extreme stress on hospital beds (Figure 24). At some point from May through September 1, 18 states will have high or extreme stress on ICU capacity (Figure 25).

Model updates

We made an update to our vaccine coverage projections this week to better account for the observed scale-up of vaccination. We used data from countries and states with minimal supply constraints (Israel, Chile, Bahrain, states in the United States, locations in the United Kingdom). We used a hierarchical spline model with a monotonicity constraint. Specifically, we model the logit fraction of the population that has been vaccinated among the population that reported that they would probably or definitely get vaccinated as a function of time since the first day of vaccination. The model was used to predict an average scale global curve for the predicted percentage of the population that is likely to be vaccinated. The resulting scale-up curve approximates better the observed slowing rate of vaccination as countries approach the maximum number of people who are willing to get vaccinated. The average scale-up curve was calibrated to the observed number of vaccinations reported to be delivered in each location. This was done by calculating the ratio of the predicted cumulative percentage vaccinated over the observed percentage vaccinated for the most recent time period. This ratio was then used to adjust the average scale-up curve. For locations without observed data, we used the regional average ratio to calibrate the scale-up curve.

Our previous model update, made the week of May 3, included the transition to measuring total COVID-19 mortality; more details are available here.

Figure 1. Reported daily COVID-19 cases

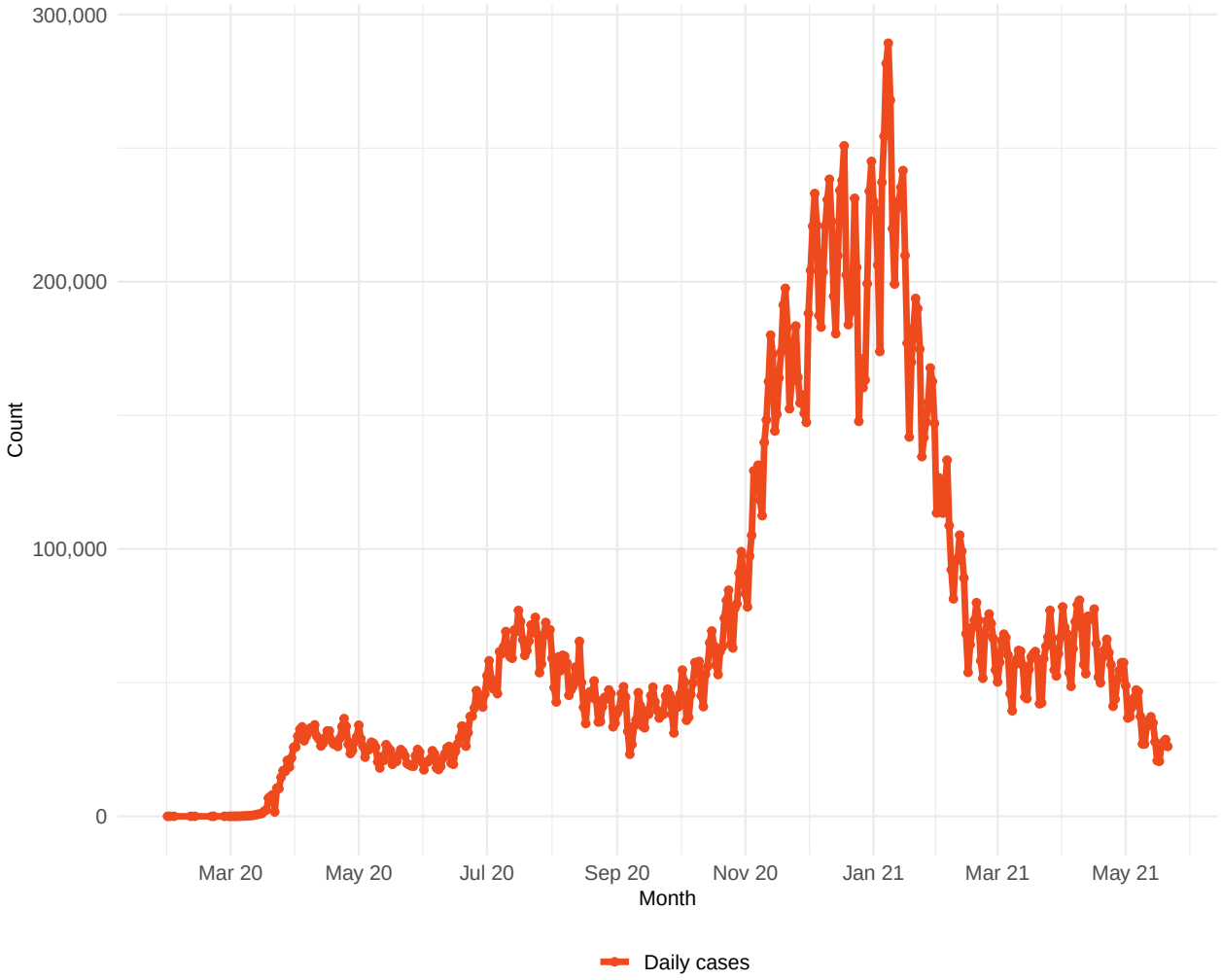


Table 1. Ranking of COVID-19 among the leading causes of mortality this week, assuming uniform deaths of non-COVID causes throughout the year

Cause name	Weekly deaths	Ranking
Ischemic heart disease	10,724	1
COVID-19	5,206	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 2. Smoothed trend estimate of reported daily COVID-19 deaths (blue) and total daily COVID-19 deaths (orange).

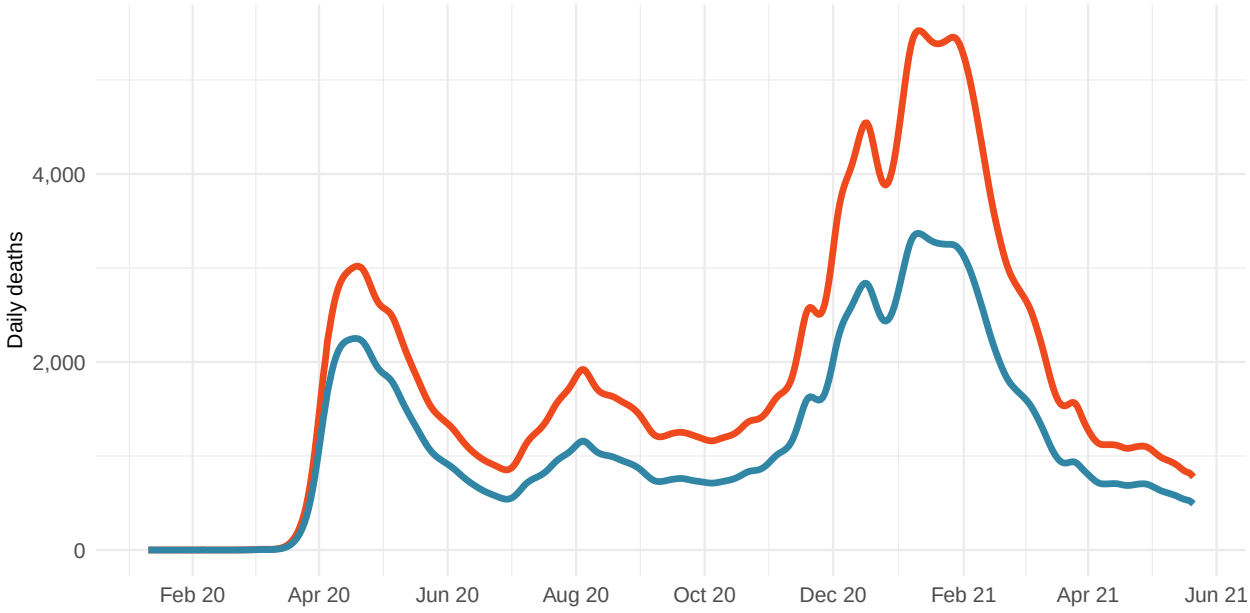


Figure 3. Daily COVID-19 death rate per 1 million on May 24, 2021

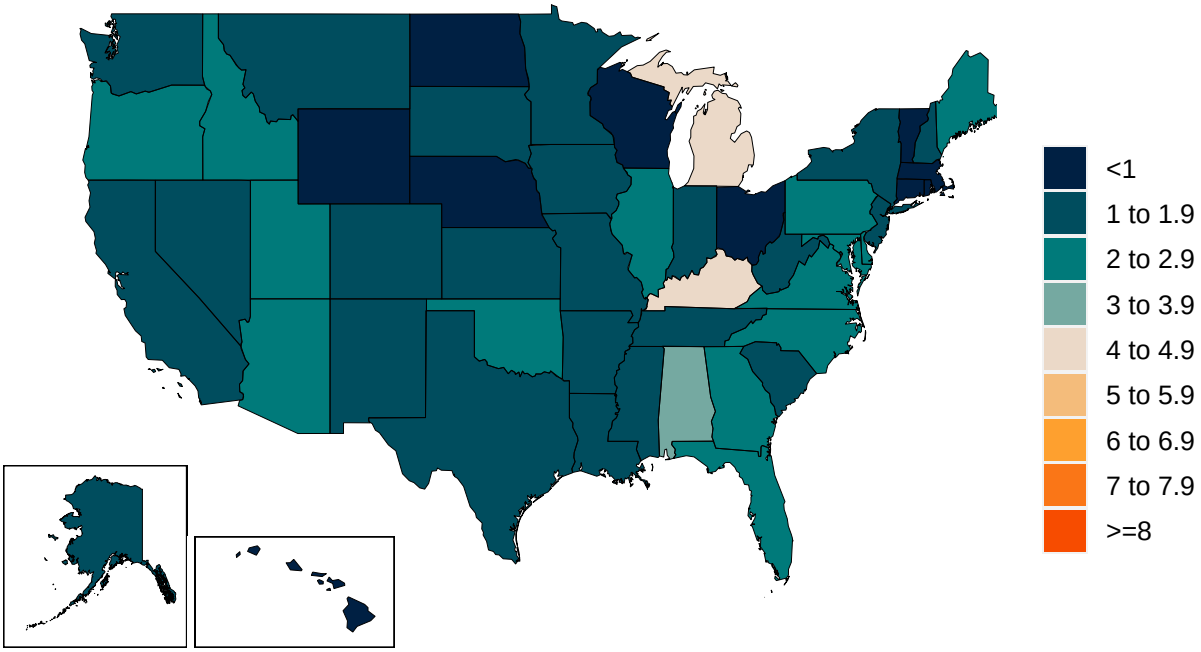


Figure 4. Cumulative COVID-19 deaths per 100,000 on May 24, 2021

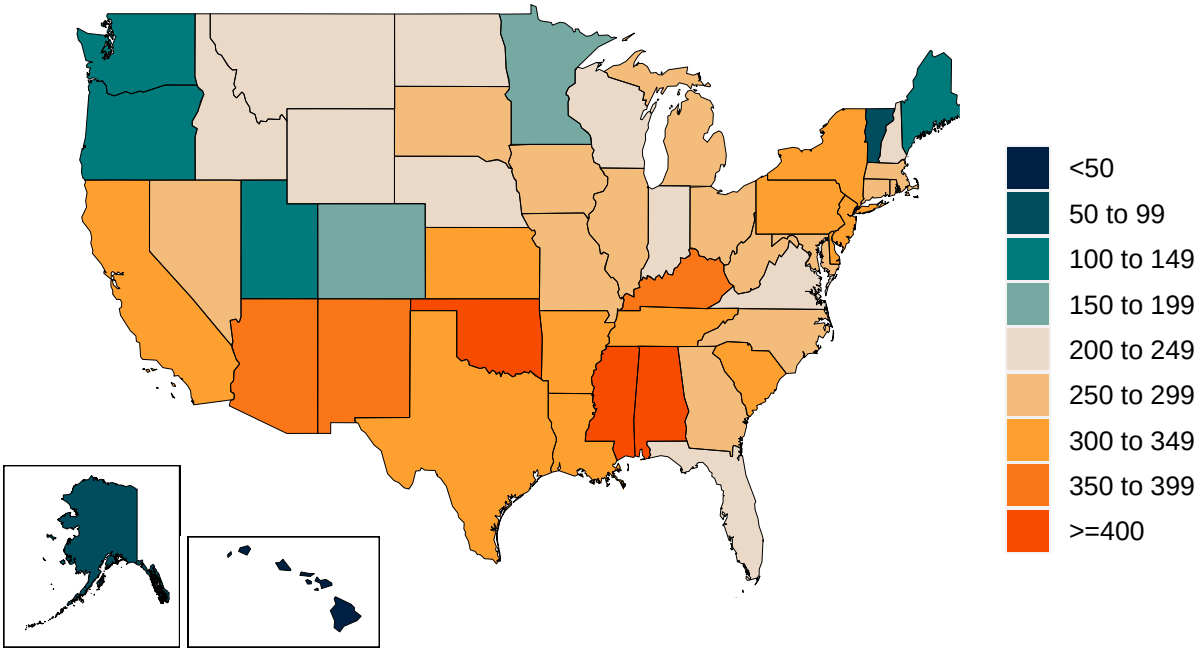


Figure 5. Estimated percent of the population infected with COVID-19 on May 24, 2021

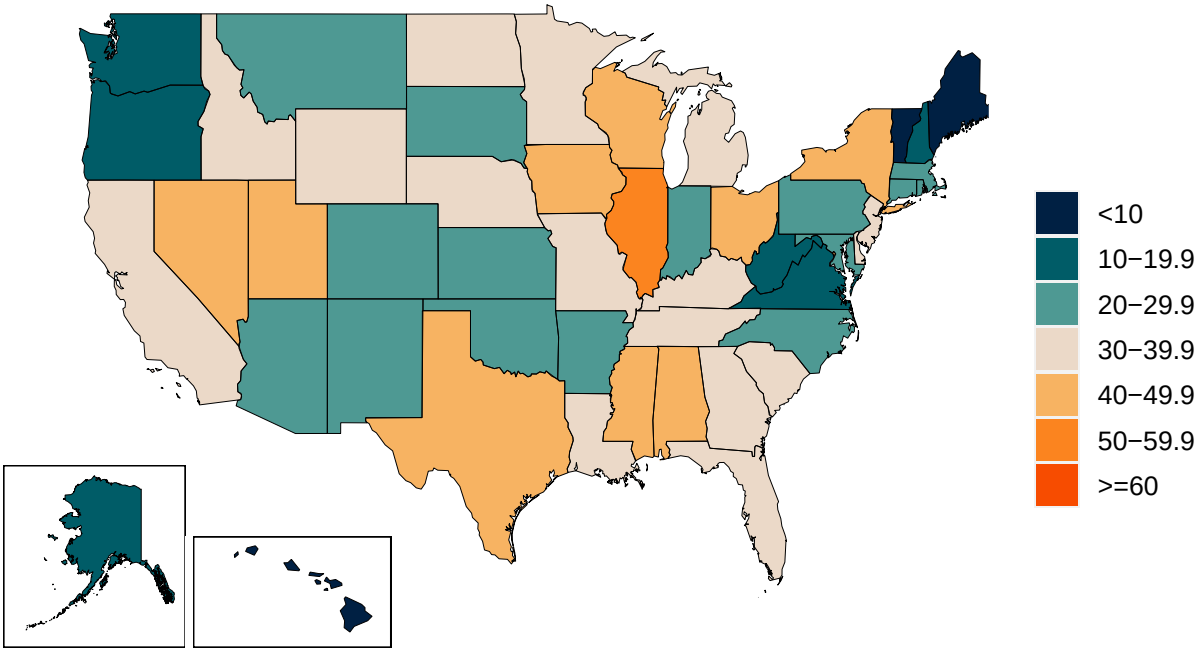


Figure 6. Mean effective R on May 13, 2021. The estimate of effective R is based on the combined analysis of deaths, case reporting, and hospitalizations where available. Current reported cases reflect infections 11-13 days prior, so estimates of effective R can only be made for the recent past. Effective R less than 1 means that transmission should decline, all other things being held the same.

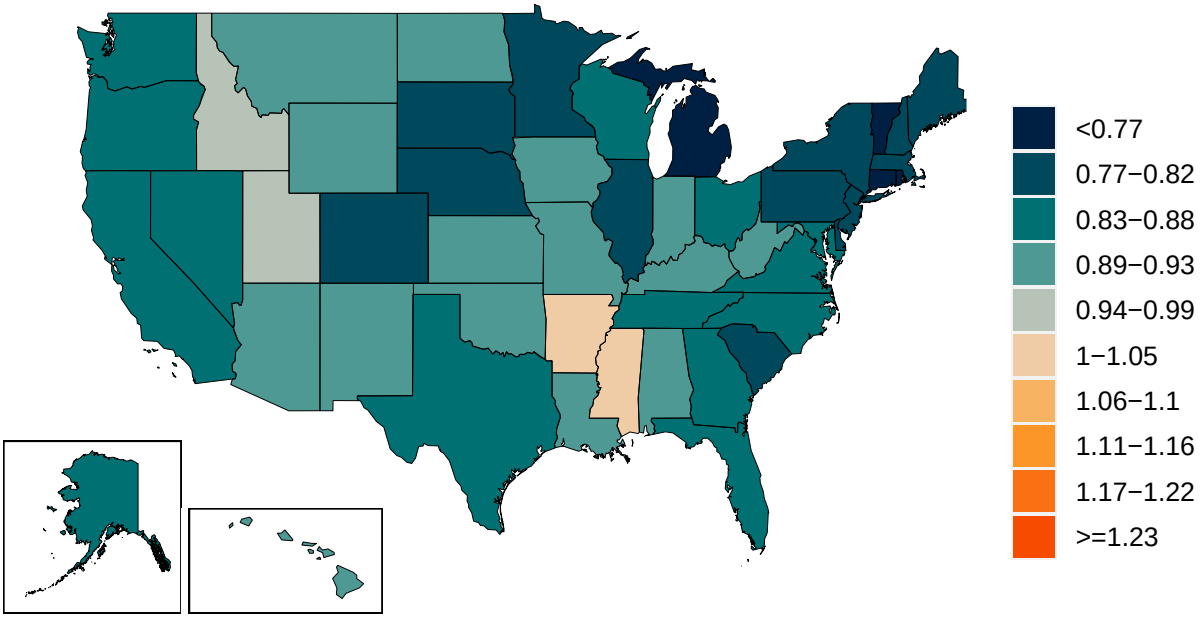
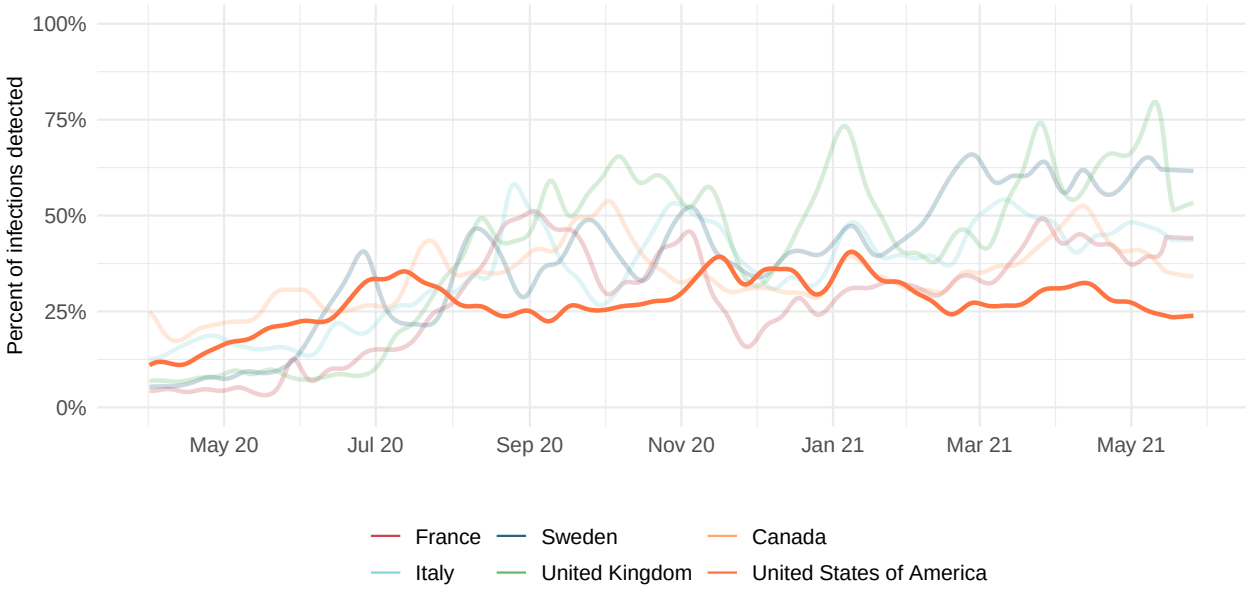


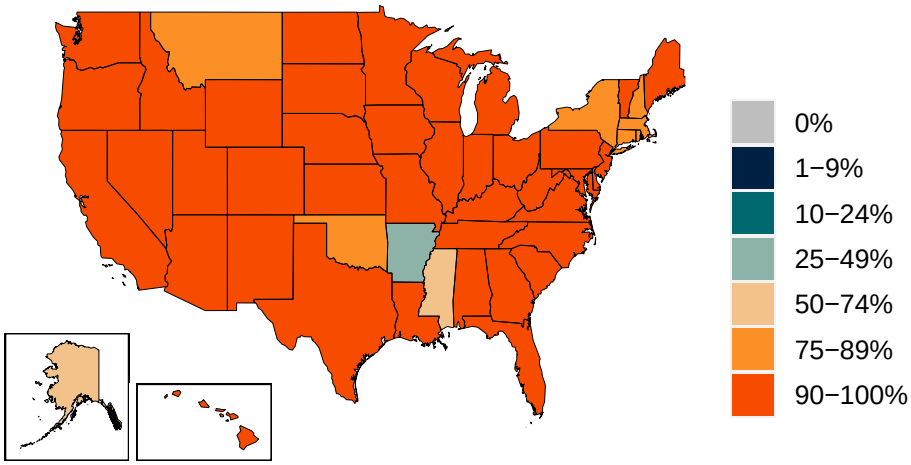
Figure 7. Percent of COVID-19 infections detected. This is estimated as the ratio of reported daily COVID-19 cases to estimated daily COVID-19 infections based on the SEIR disease transmission model.



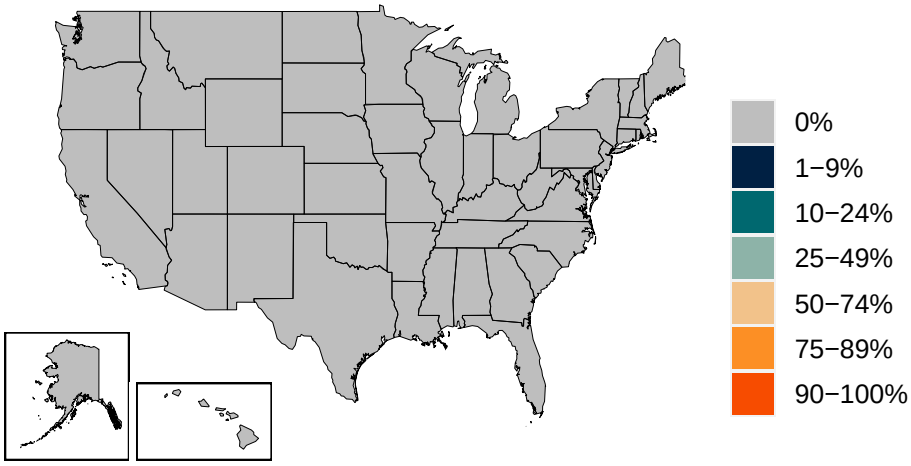
*Due to measurement errors in cases and testing rates, the infection to detection rate (IDR) can exceed 100% at particular points in time.

Figure 8. Estimated percent of circulating SARS-CoV-2 for primary variant families on May 24, 2021.

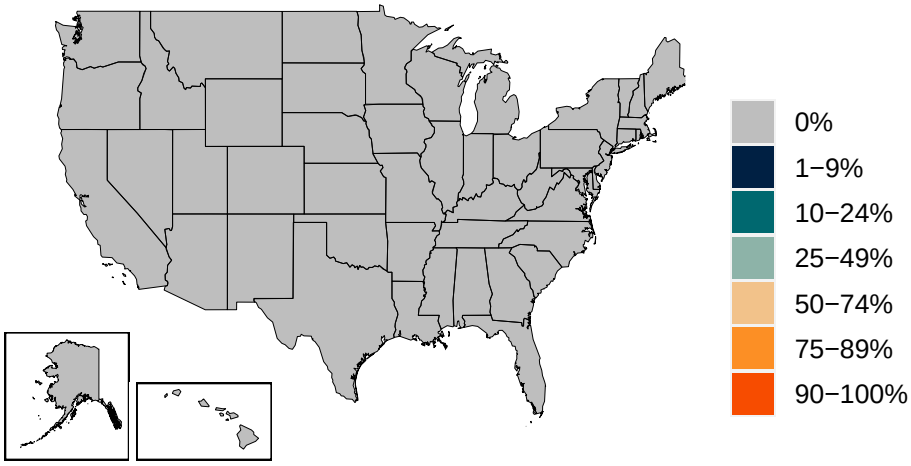
A. Estimated percent B.1.1.7 variant



B. Estimated percent B.1.351 variant



C. Estimated percent B.1.617 variant



D. Estimated percent P.1 or P.3 variant

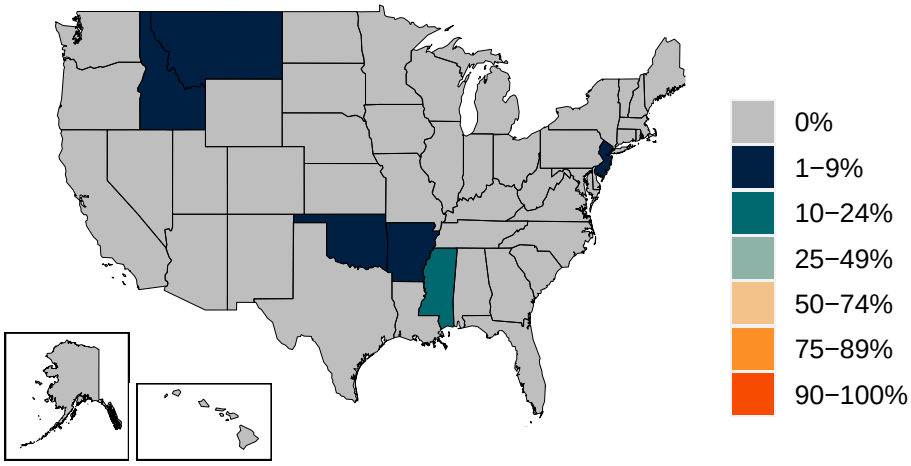
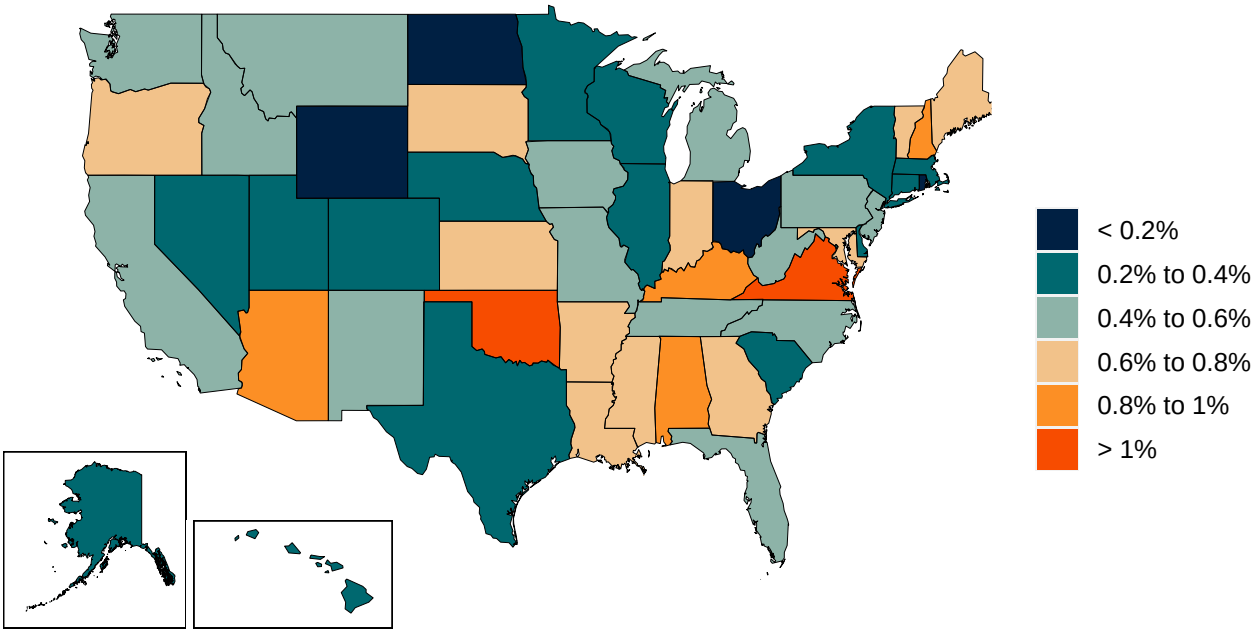
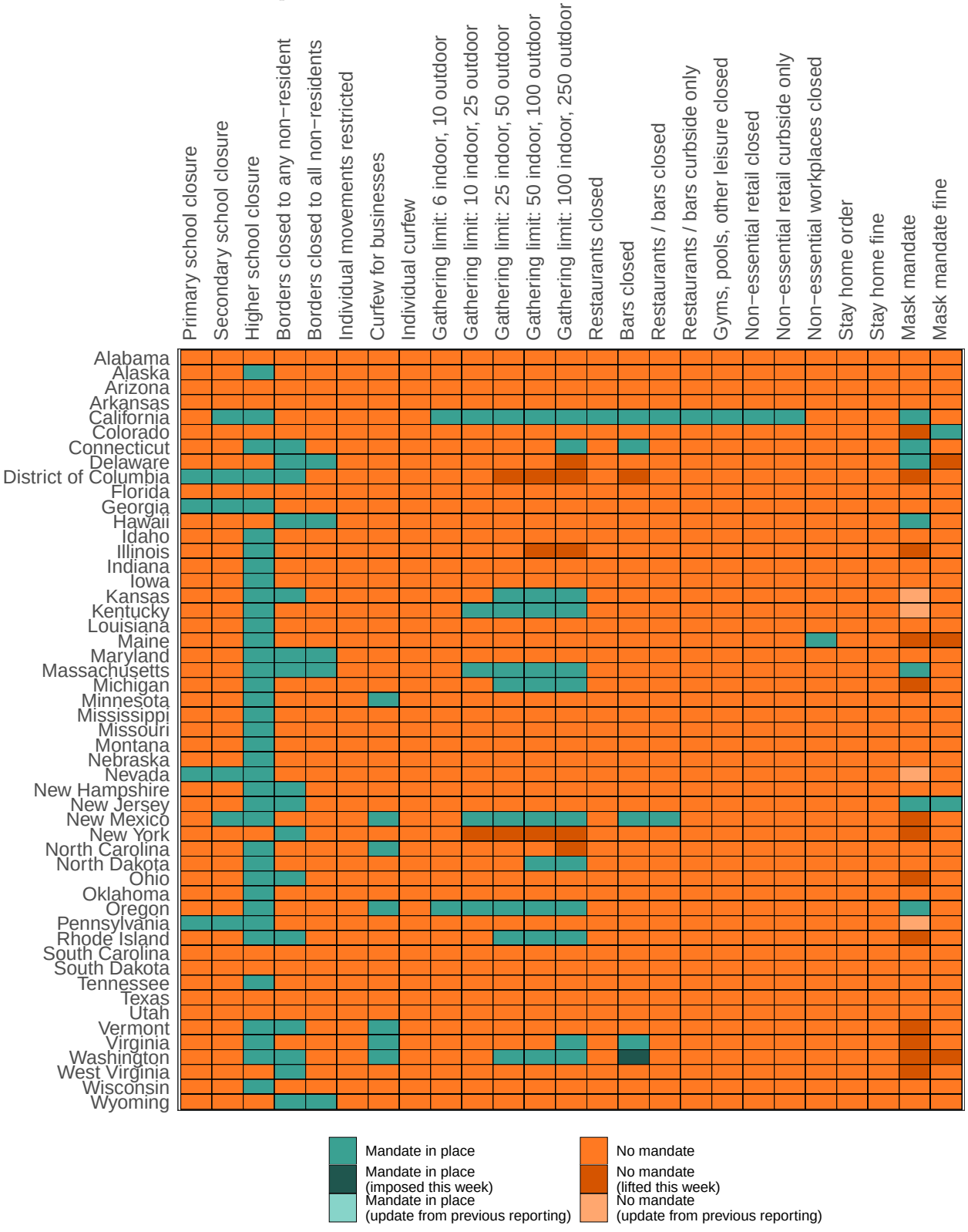


Figure 9. Infection fatality ratio on May 24, 2021. This is estimated as the ratio of COVID-19 deaths to infections based on the SEIR disease transmission model.



Critical drivers

Table 2. Current mandate implementation



*Not all locations are measured at the subnational level.

Figure 10. Trend in mobility as measured through smartphone app use compared to January 2020 baseline

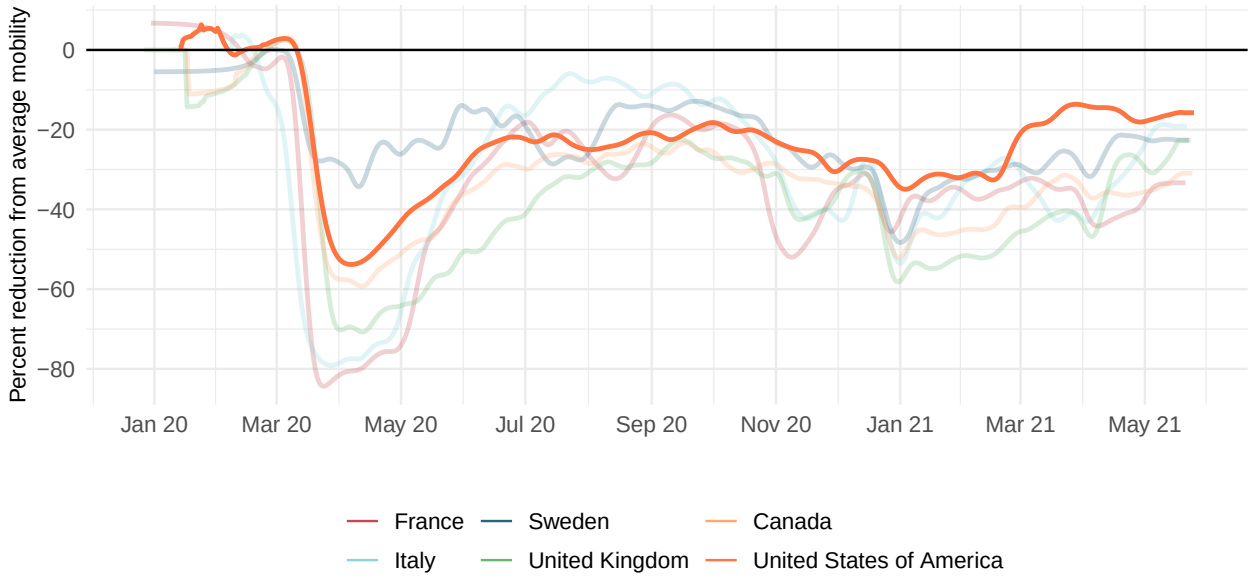


Figure 11. Mobility level as measured through smartphone app use compared to January 2020 baseline (percent) on May 24, 2021

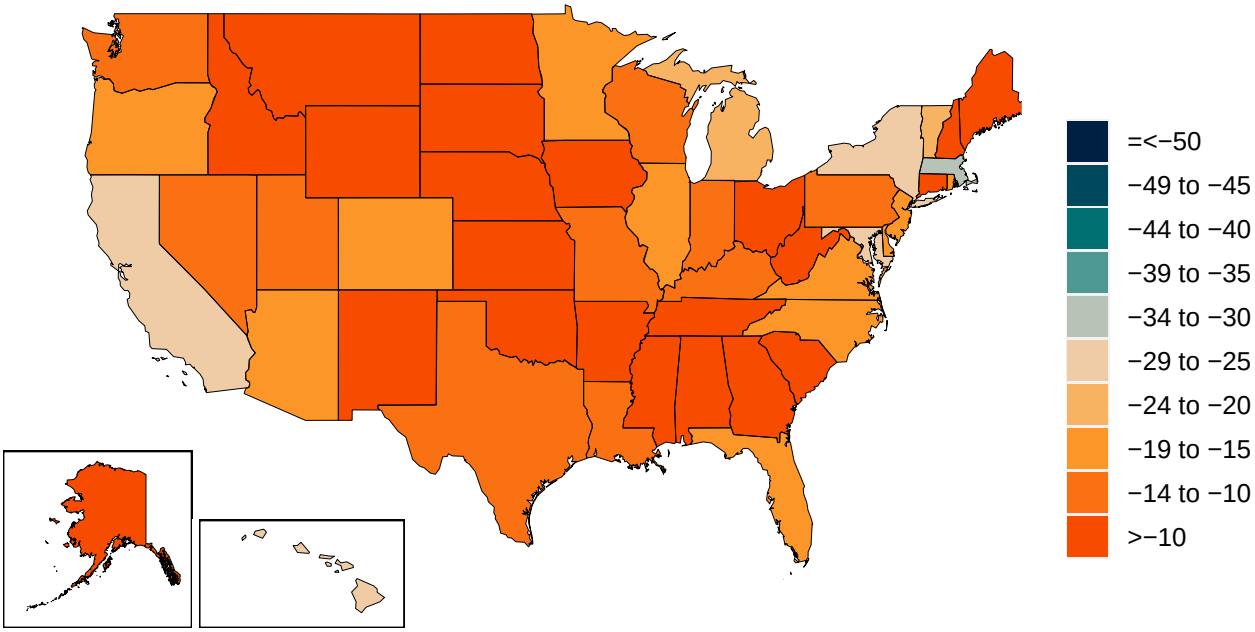


Figure 12. Trend in the proportion of the population reporting always wearing a mask when leaving home

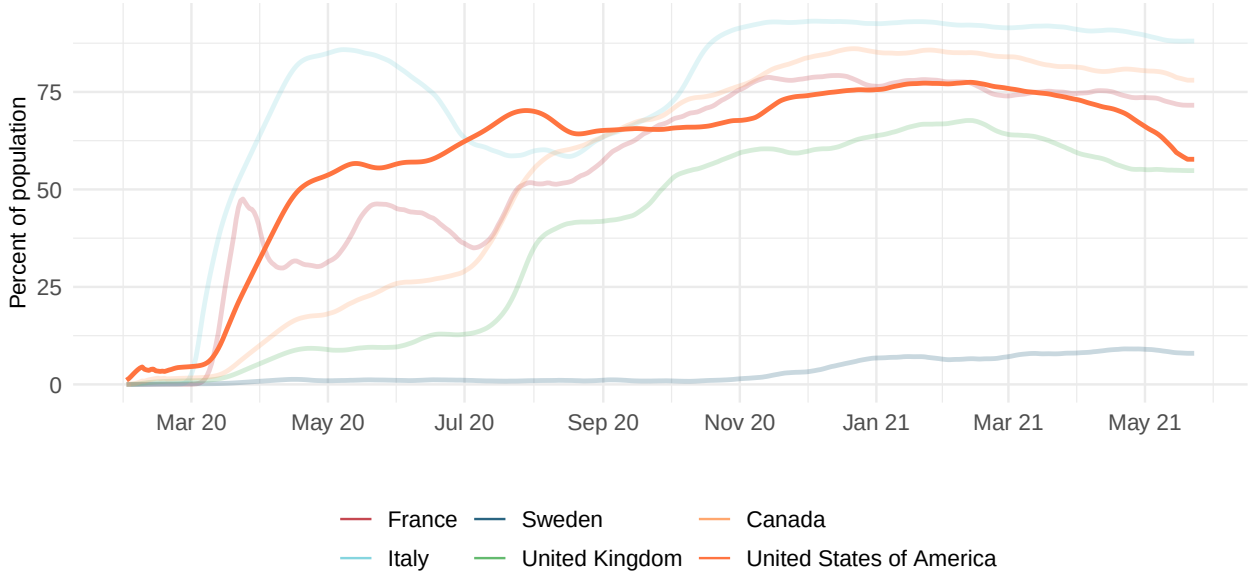


Figure 13. Proportion of the population reporting always wearing a mask when leaving home on May 24, 2021

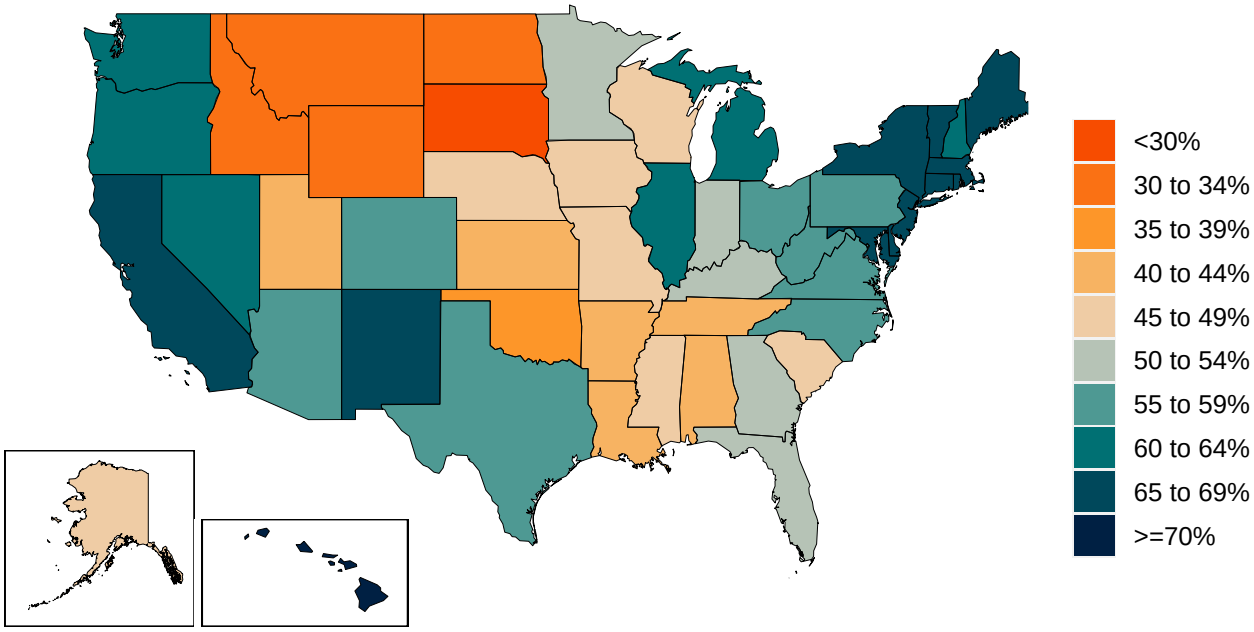


Figure 14. Trend in COVID-19 diagnostic tests per 100,000 people

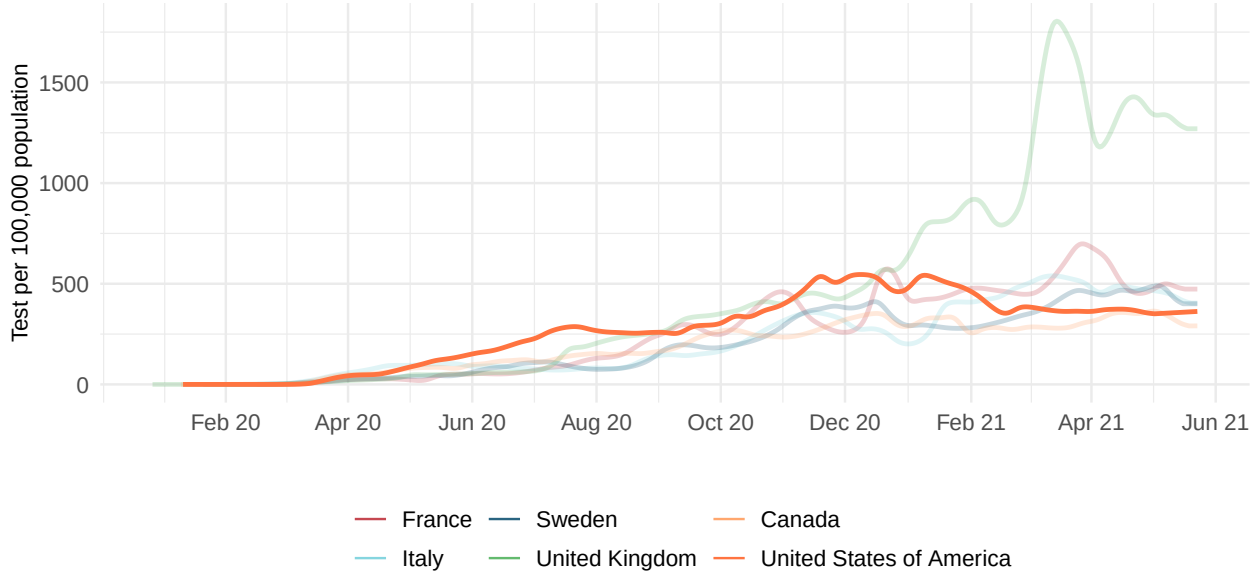


Figure 15. COVID-19 diagnostic tests per 100,000 people on May 24, 2021

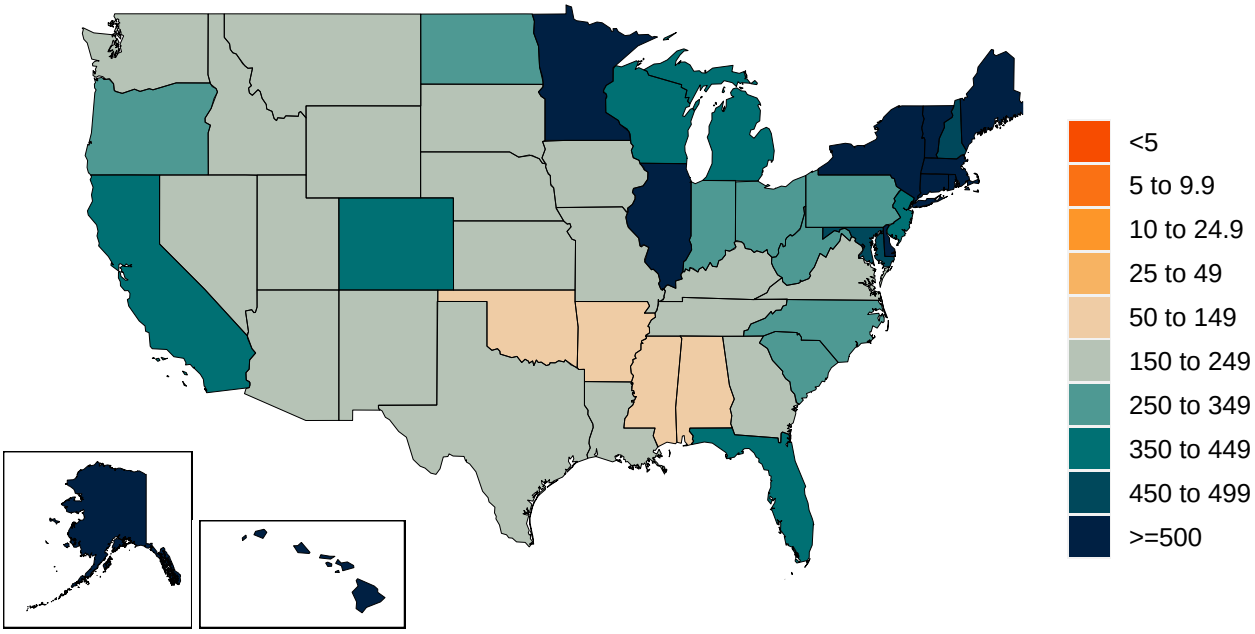


Figure 16. Increase in the risk of death due to pneumonia on February 1 compared to August 1

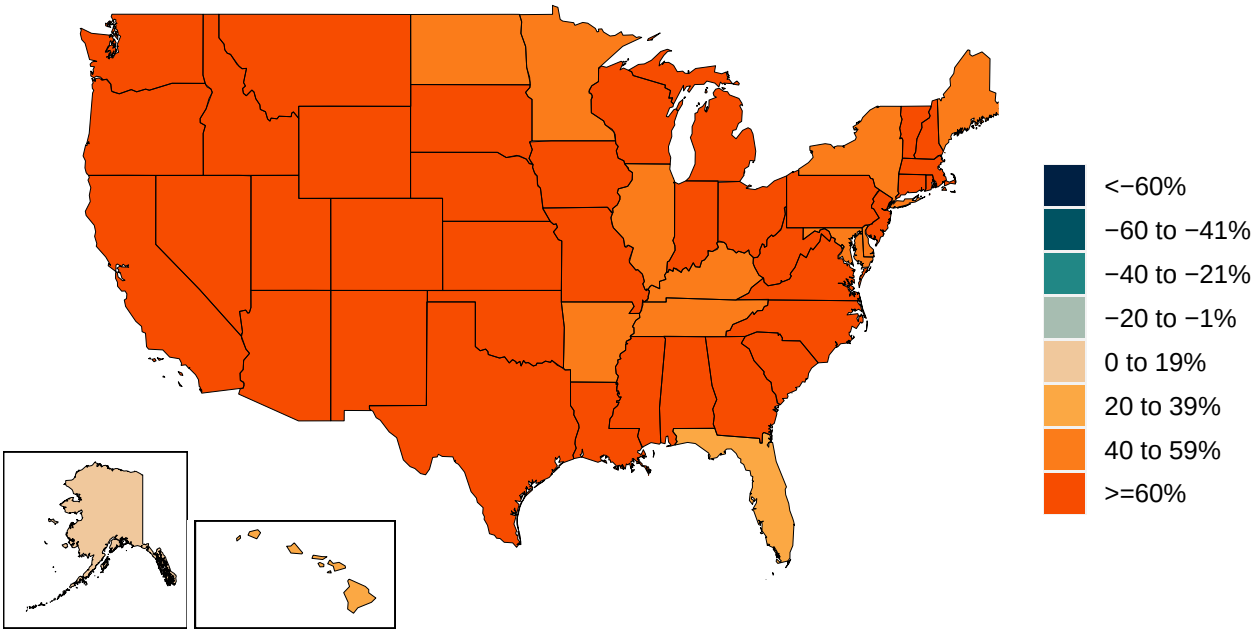


Table 3. The SEIR model uses variant-specific estimates of vaccine efficacy at preventing symptomatic disease and at preventing infection. We use data from clinical trials directly, where available, and make estimates otherwise. More information can be found on our website (http://www.healthdata.org/node/8584).

Vaccine	Efficacy at preventing disease: D614G & B.1.1.7	Efficacy at preventing infection: D614G & B.1.1.7	Efficacy at preventing disease: B.1.351, B.1.617, & P.1	Efficacy at preventing infection: B.1.351, B.1.617, & P.1
AstraZeneca	74%	52%	10%	9%
CoronaVac	50%	44%	38%	33%
Covaxin	78%	69%	59%	52%
Janssen	72%	72%	64%	56%
Moderna	94%	89%	79%	75%
Novavax	89%	79%	49%	43%
Pfizer/BioNTech	91%	86%	76%	72%
Sinopharm	73%	65%	55%	49%
Sputnik-V	92%	81%	70%	61%
Tianjin CanSino	66%	58%	50%	44%
Other vaccines	75%	66%	57%	50%
Other vaccines (mRNA)	91%	86%	76%	72%

Figure 17. 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.

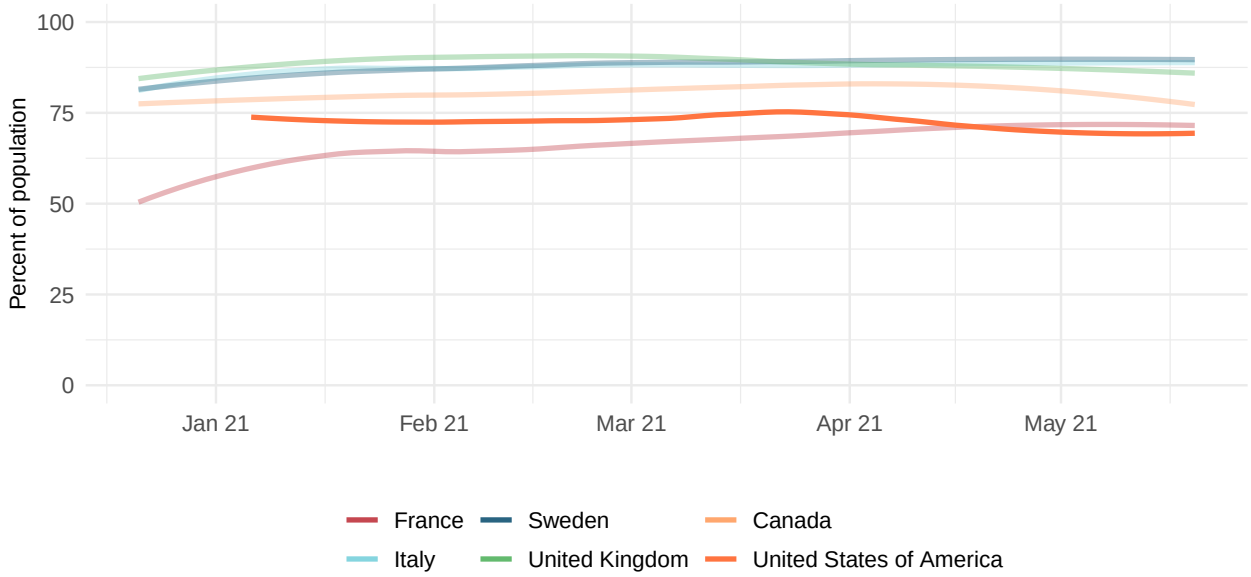


Figure 18. This figure shows the estimated proportion of the adult (18+) population that has been vaccinated or would probably or definitely receive the COVID-19 vaccine if available.

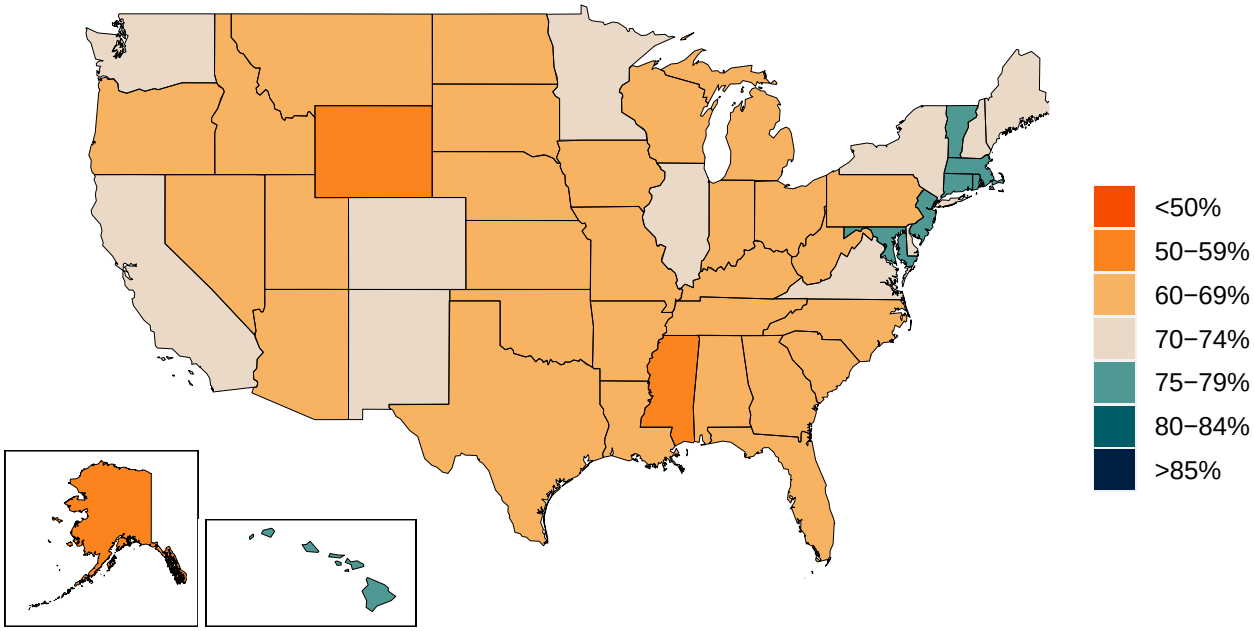
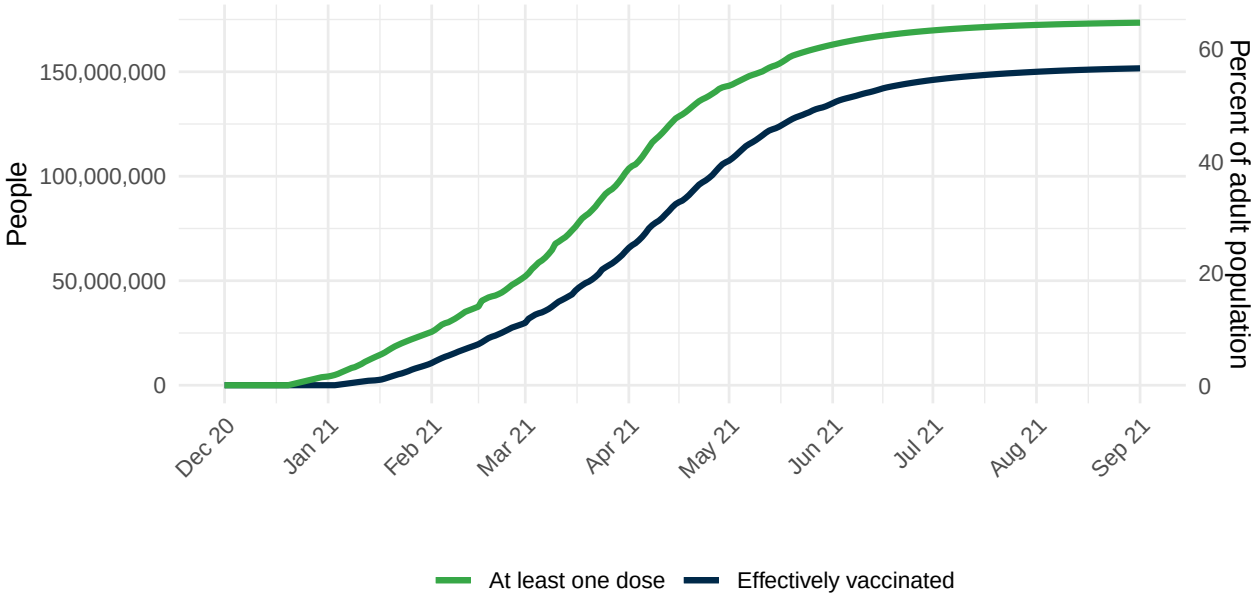


Figure 19. The number of people who receive any vaccine and those who are effectively vaccinated and protected against disease, accounting for efficacy, loss to follow up for two-dose vaccines, partial immunity after one dose, and immunity after two doses.



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.
- 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 scenario assumes that mandates are re-imposed when daily deaths reach 15 per million.
- Variants B.1.1.7 (first identified in the UK), B.1.351 (first identified in South Africa), and P1 (first identified in Brazil) continue to spread from locations with (a) more than 5 sequenced variants, and (b) reports of community transmission, to adjacent locations following the speed of variant scale-up observed in the regions of the UK.
- In one-quarter of those vaccinated, mobility increases toward pre-COVID-19 levels.

The **worse scenario** modifies the reference scenario assumptions in three ways:

- First, it assumes that variants B.1.351 or P1 begin to spread within 3 weeks in adjacent locations that do not already have B.1.351 or P1 community transmission.
- Second, it assumes that all those vaccinated increase their mobility toward pre-COVID-19 levels.
- Third, it assumes that among those vaccinated, mask use starts to decline exponentially one month after completed vaccination.

The **universal masks scenario** makes all the same assumptions as the reference scenario but also assumes 95% of the population wear masks in public in every location.

Figure 20. Cumulative COVID-19 deaths until September 01, 2021 for three scenarios

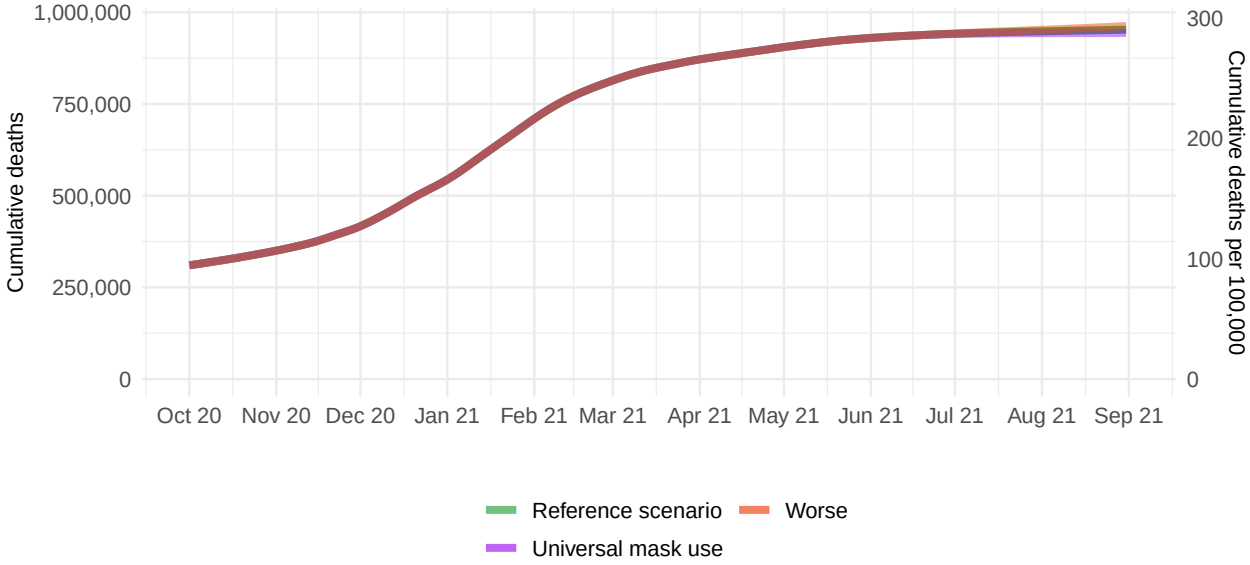


Figure 21. Daily COVID-19 deaths until September 01, 2021 for three scenarios,

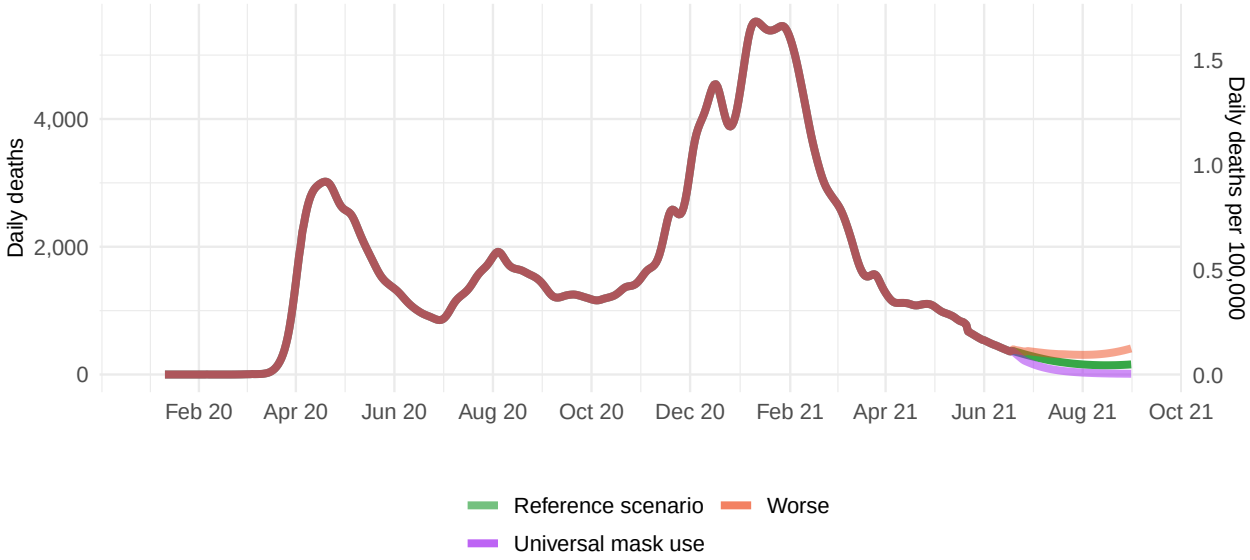


Figure 22. Daily COVID-19 infections until September 01, 2021 for three scenarios.

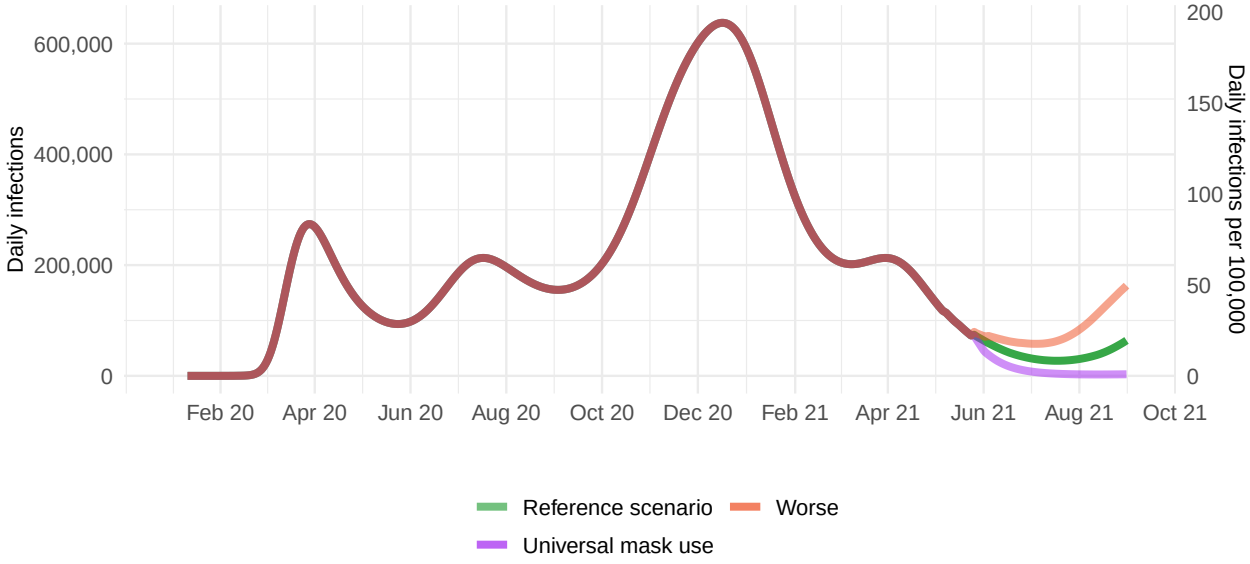


Figure 23. Comparison of reference model projections with other COVID modeling groups. For this comparison, we are including projections of daily COVID-19 deaths from other modeling groups when available: Delphi from the Massachussets Institute of Technology (Delphi; https://www.covidanalytics.io/home), Imperial College London (Imperial; https://www.covidsim.org), The Los Alamos National Laboratory (LANL; https://covid-19.bsvgateway.org/), the SI-KJalpha model from the University of Southern California (SIKJalpha; https://github.com/scc-usc/ReCOVER-COVID-19), and the CDC Ensemble Model (CDC; https://www.cdc.gov/coronavirus/2019-ncov/covid-data/forecasting-us.html#ensembleforecast.) Daily deaths from other modeling groups are smoothed to remove inconsistencies with rounding. Regional values are aggregates from available locations in that region.

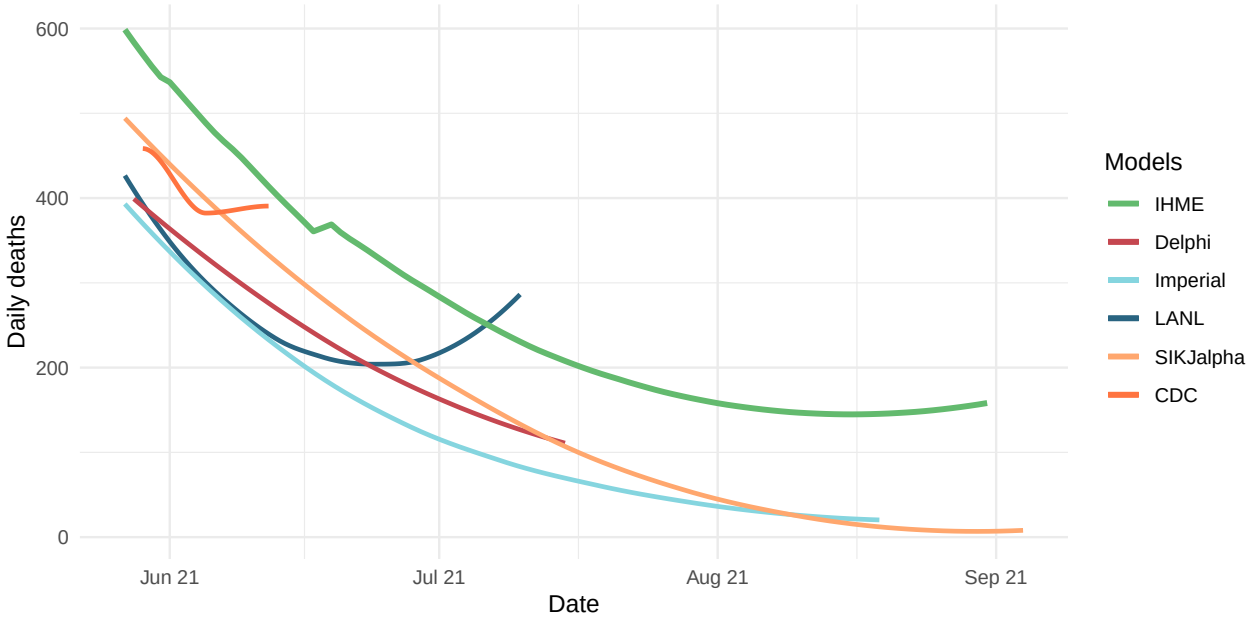


Figure 24. The estimated inpatient hospital usage is shown over time. The percent of hospital beds occupied by COVID-19 patients is color coded based on observed quantiles of the maximum proportion of beds occupied by COVID-19 patients. Less than 5% is considered *low stress*, 5-9% is considered *moderate stress*, 10-19% is considered *high stress*, and greater than 20% is considered *extreme stress*.

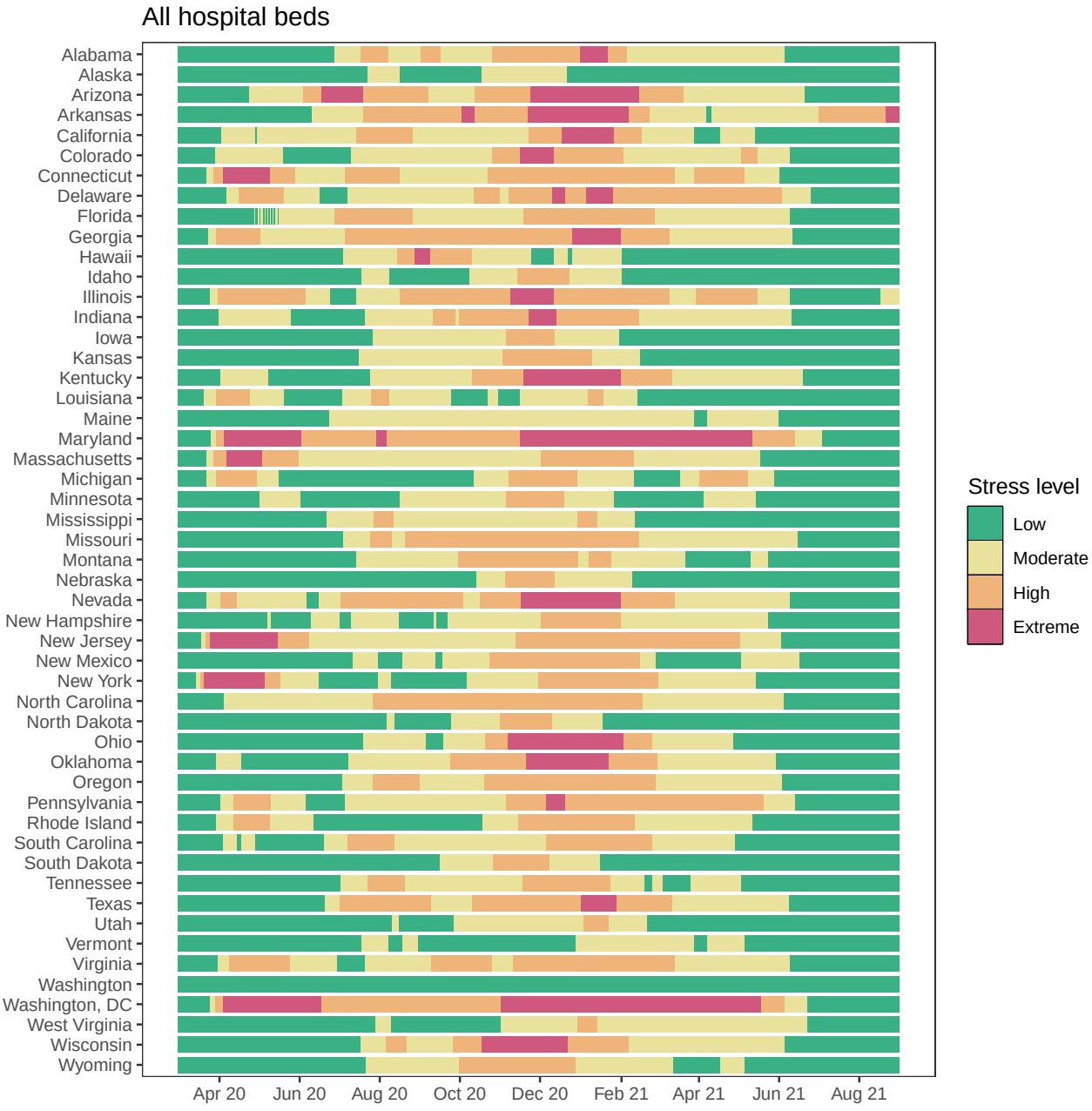
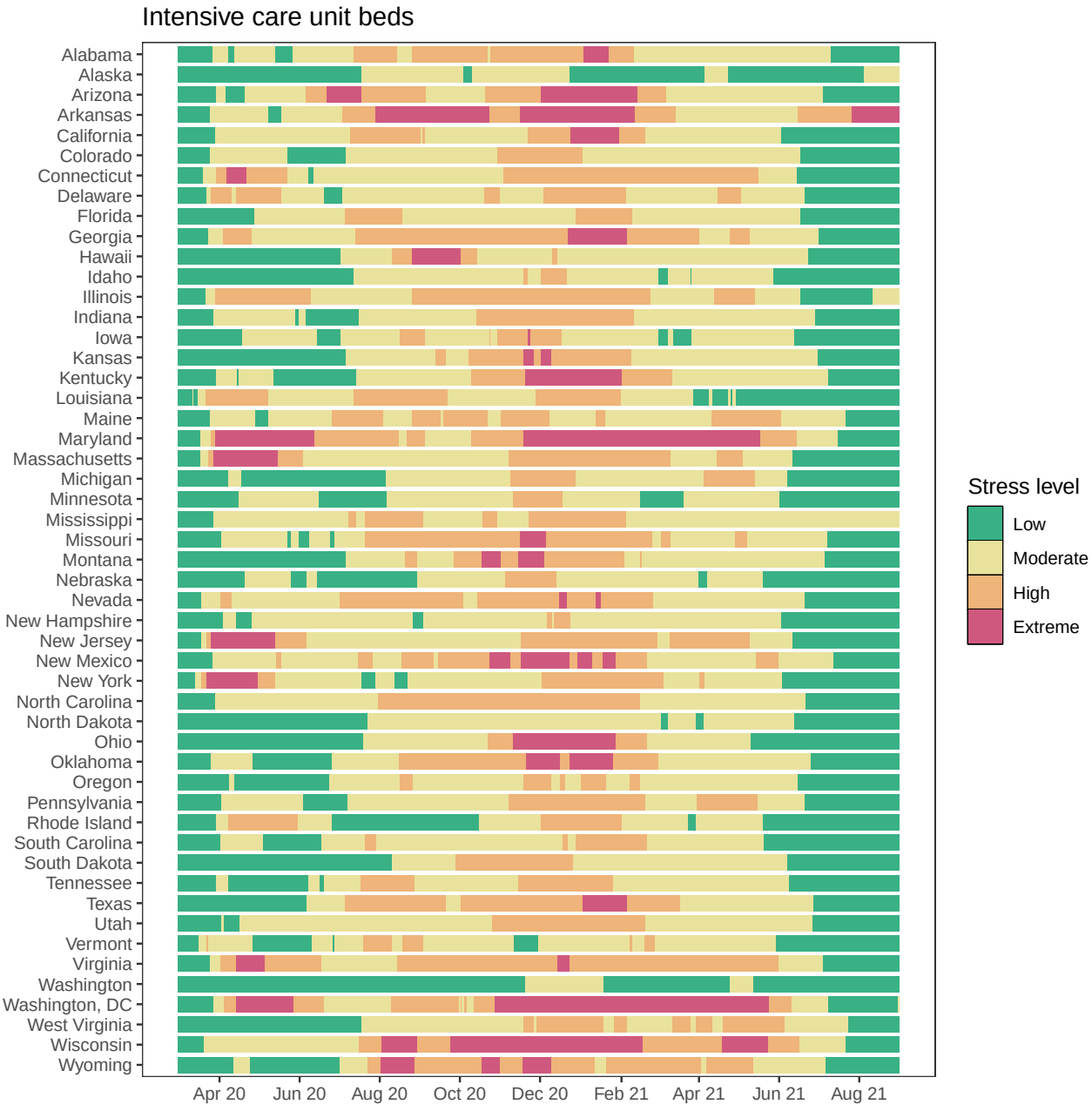


Figure 25. The estimated intensive care unit (ICU) usage is shown over time. The percent of ICU beds occupied by COVID-19 patients is color coded based on observed quantiles of the maximum proportion of ICU beds occupied by COVID-19 patients. Less than 10% is considered *low stress*, 10-29% is considered *moderate stress*, 30-59% is considered *high stress*, and greater than 60% is considered *extreme stress*.



More information

Data sources:

Mask use and vaccine confidence data are from the Global COVID-19 Symptom Survey (this research is based on survey results from University of Maryland Social Data Science Center with Facebook's support) and the US COVID-19 Symptom Survey (this research is based on survey results from Carnegie Mellon University's Delphi Research Group with Facebook's support). 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.

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