COVID-19 Results Briefing

The United States of America

April 15, 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 April 13, 2021, with data through April 12, 2021.

The major surge in Michigan may be slowing, according to reported cases. Lesser surges have occurred in Minnesota and New Jersey, and increases in cases but not deaths have occurred in many other states. So far, other than in Michigan, the European pattern of a major B.1.1.7-fueled surge has not spread widely in the US. The slow national increase in cases and hospitalizations and decline in deaths despite widespread B.1.1.7 circulation may be due to three factors: higher past levels of infection in the US compared to Europe, higher vaccination rates on average than in Europe, and the arrival of B.1.1.7 after the peak of winter seasonality. Facebook data suggest that mask use is remaining relatively high, although many anecdotal sources suggest that actual use may be rapidly declining. More rapid declines in mask use and more rapid increases in mobility can lead to rising infection and case numbers and stagnant deaths over many months. The trend toward mandate easing continues, and it appears quite possible there will be a huge behavioral rebound. Strategies to manage the epidemic in this phase remain similar to the past few weeks. First, every effort should be made to counter the slow decline in vaccine confidence. We expect to reach the limit of demand sometime in May with current trends. Second, states should try to sustain mask use. Sustaining mask use can make a major difference to the probability of a B.1.1.7 surge spreading more widely in the US. Third, every effort should be made to avoid introduction of escape variants such as B.1.351, P1, and the double mutant found in India from spreading more widely in the US.

Current situation

- Daily reported cases in the last week increased to 66,600 per day on average compared to 64,400 the week before (Figure 1).
- Daily deaths in the last week decreased to 720 per day on average compared to 780 the week before (Figure 2). 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 Georgia, Michigan, and New Jersey (Figure 3).
- We estimated that 22% of people in the US have been infected as of April 12 (Figure 4).
- Effective R, computed using cases, hospitalizations, and deaths, is greater than 1 in 36 states (Figure 5). Effective R is over 1.1 in Washington, Nebraska, Minnesota, Michigan, Maine, and Hawaii.
- The infection-detection rate in the US was close to 55% on April 12 (Figure 6).

- Variant B.1.1.7 continues to spread in the US. Our estimates of current prevalence are based on CDC- and GISAID-released sequences and a variant spread model to update the estimates to this week (Figure 7). While there are states reporting B.1.351 and P1, prevalence remains low. We estimate higher prevalence of B.1.351 in South Carolina.

Trends in drivers of transmission

- Mandates continue to be lifted. Mask mandates were removed in Alabama and Indiana. Pennsylvania lifted bar closures. New Jersey relaxed gathering restrictions. At this point, restrictions are steadily declining to a minimal level, with the exception of large gathering restrictions in many states, high school closures, and mask mandates.
- Mobility last week was 14% lower than the pre-COVID-19 baseline (Figure 9). Mobility was near baseline (within 10%) in 26 states.
- As of April 12, among Facebook survey respondents, 73% of people said they always wore a mask when leaving their home (Figure 11). Self-reported mask use was lower than 50% in South Dakota and Wyoming. There may be reason to believe that self-reported use is higher than actual use.
- There were 369 diagnostic tests per 100,000 people on April 12 (Figure 13).
- In the US, 67.4% of people say they have been vaccinated or would accept or would probably accept a vaccine for COVID-19. This has slowly but steadily declined from a high near 75% at the beginning of February. The fraction of the population who are open to receiving a COVID-19 vaccine ranges from 49% in Wyoming to 86% in the District of Columbia (Figure 17).
- In our current reference scenario, we expect that 176 million will be vaccinated by August 1 (Figure 18). These estimates are down due to the Johnson & Johnson vaccine being on hold and declining vaccine confidence. We expect further vaccination to become demand-constrained in May.

Projections

- In our **reference scenario**, which represents what we think is most likely to happen, our model projects 618,000 cumulative deaths on August 1, 2021. This represents 58,000 additional deaths from April 12 to August 1 (Figure 19). Daily deaths are expected to decline from a peak around May 1 and then decline to low levels by August 1 (Figure 20).
- If **universal mask coverage (95%)** were attained in the next week, our model projects 13,000 fewer cumulative deaths compared to the reference scenario on August 1, 2021 (Figure 19).
- Under our **worse scenario**, which includes faster reductions in mask use and faster increases in mobility, our model projects 679,000 cumulative deaths on August 1, 2021, an additional 61,000 deaths compared to our reference scenario (Figure 19).
- By August 1, we project that 52,600 lives will be saved by the projected vaccine rollout.

- Daily infections are expected in the reference scenario to decline steadily over the next months. In the worse scenario, daily infections remain remarkably stable over the next four months, declining only slightly by August 1.
- Figure 22 compares our reference scenario forecasts to other publicly archived models. IHME, USC, and the CDC ensemble have very similar forecast over the next four weeks. Los Alamos National Labs and MIT (Delphi) forecast more steady declines in the daily death rate. Imperial has a slow decline, but daily deaths remain near current levels until July.
- At some point from April through August 1, 12 states will have high or extreme stress on hospital beds (Figure 23). At some point from April through August 1, four states will have high or extreme stress on ICU capacity (Figure 24).

Model updates

There are no major updates in the model this week.

Figure 1. Reported daily COVID-19 cases

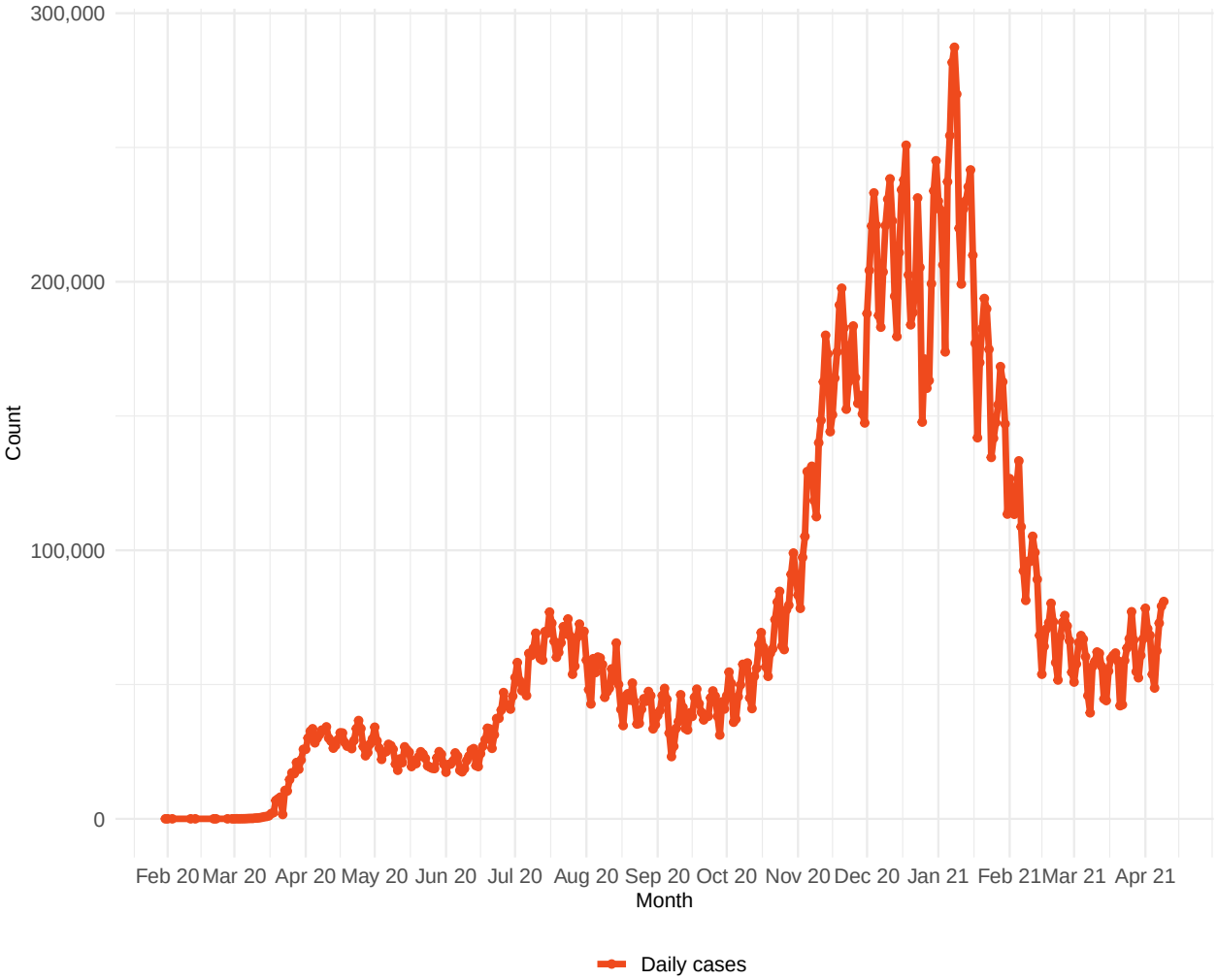


Table 1. Ranking of COVID-19 among the leading causes of mortality this week, assuming uniform deaths of non-COVID causes throughout the year

Cause name	Weekly deaths	Ranking
Ischemic heart disease	10,724	1
COVID-19	5,033	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. Reported daily COVID-19 deaths and smoothed trend estimate.

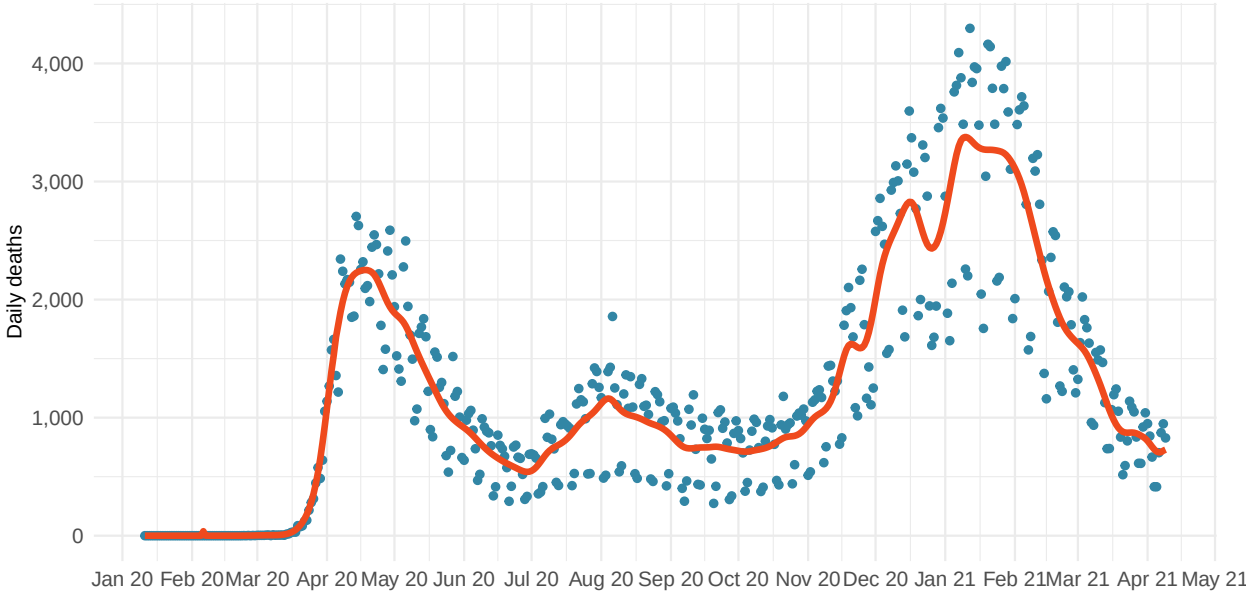


Figure 3. Daily COVID-19 death rate per 1 million on April 12, 2021

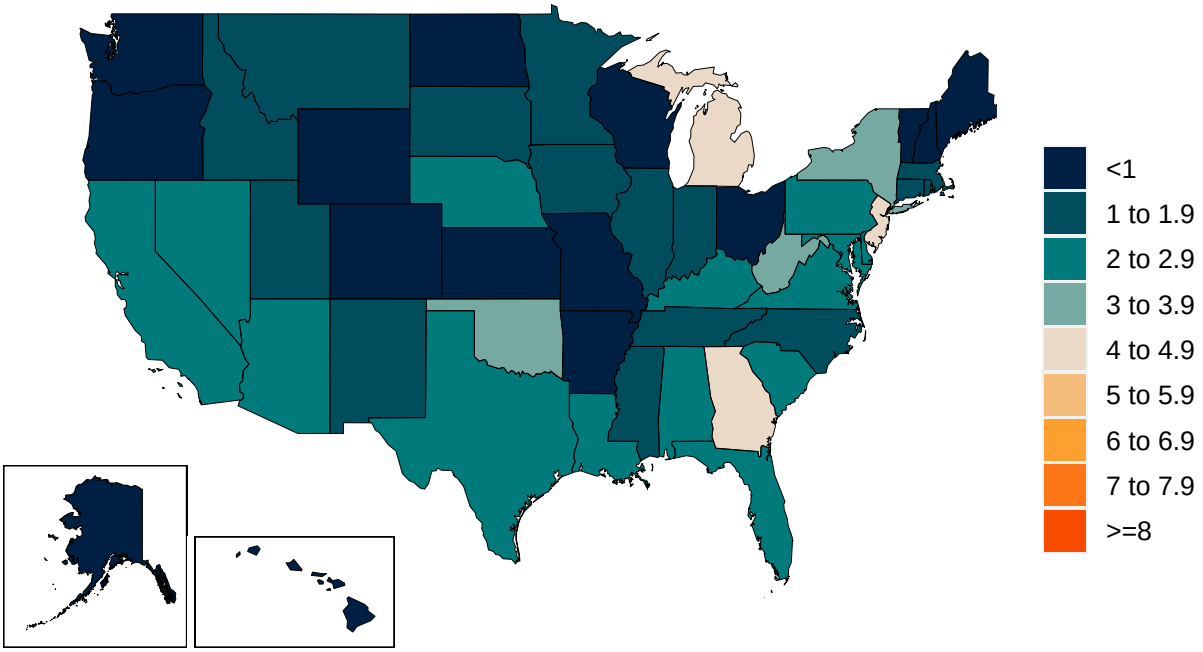


Figure 4. Estimated percent of the population infected with COVID-19 on April 12, 2021

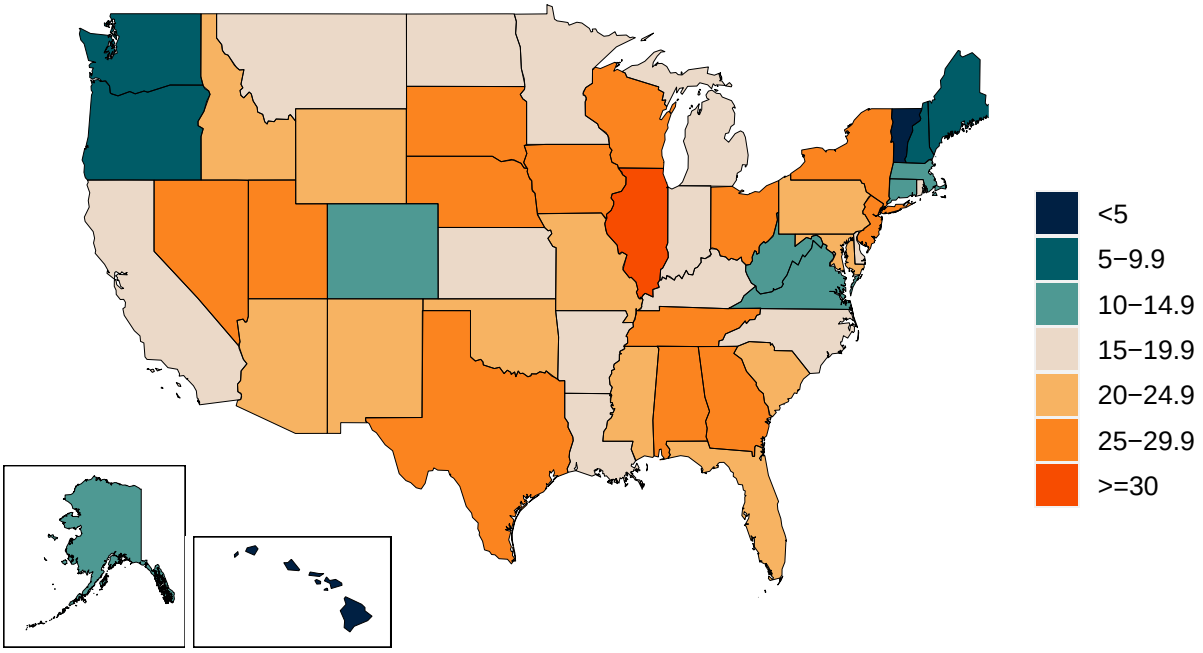


Figure 5. Mean effective R on April 01, 2021. The estimate of effective R is based on the combined analysis of deaths, case reporting, and hospitalizations where available. Current reported cases reflect infections 11-13 days prior, so estimates of effective R can only be made for the recent past. Effective R less than 1 means that transmission should decline, all other things being held the same.

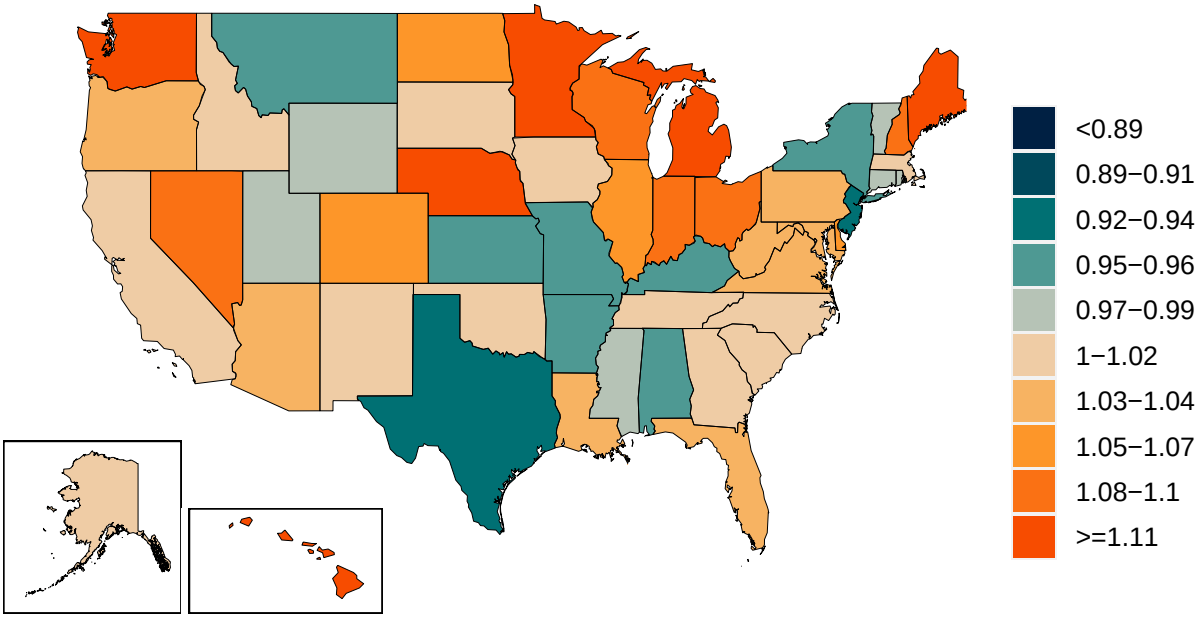
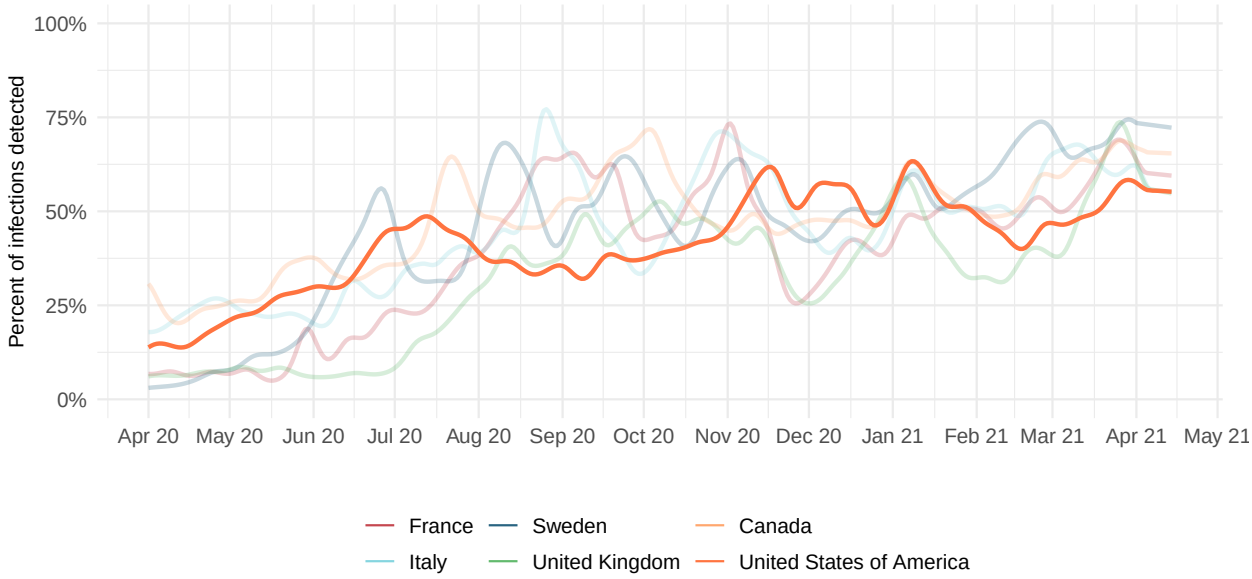


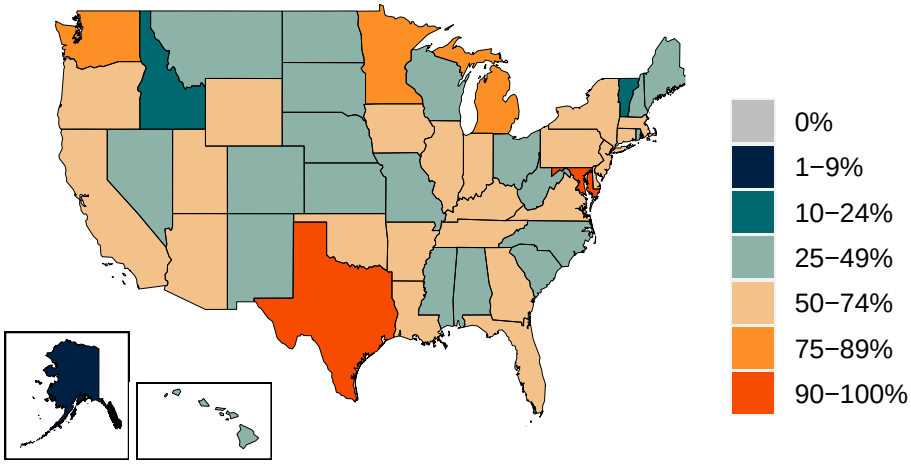
Figure 6. Percent of COVID-19 infections detected. This is estimated as the ratio of reported daily COVID-19 cases to estimated daily COVID-19 infections based on the SEIR disease transmission model.



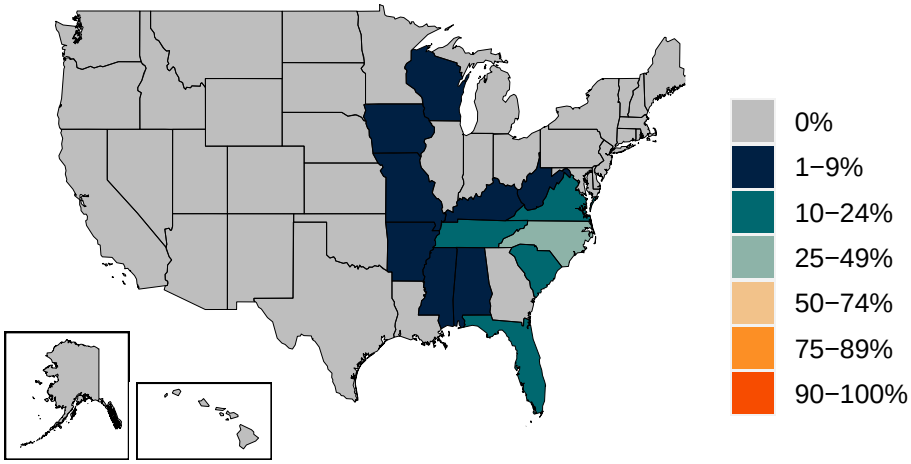
*Due to measurement errors in cases and testing rates, the infection to detection rate (IDR) can exceed 100% at particular points in time.

Figure 7. Percent of circulating SARS-CoV-2 for 3 primary variants on April 12, 2021.

A. Percent B.1.1.7 variant



B. Percent B.1.351 variant



C. Percent P1 variant

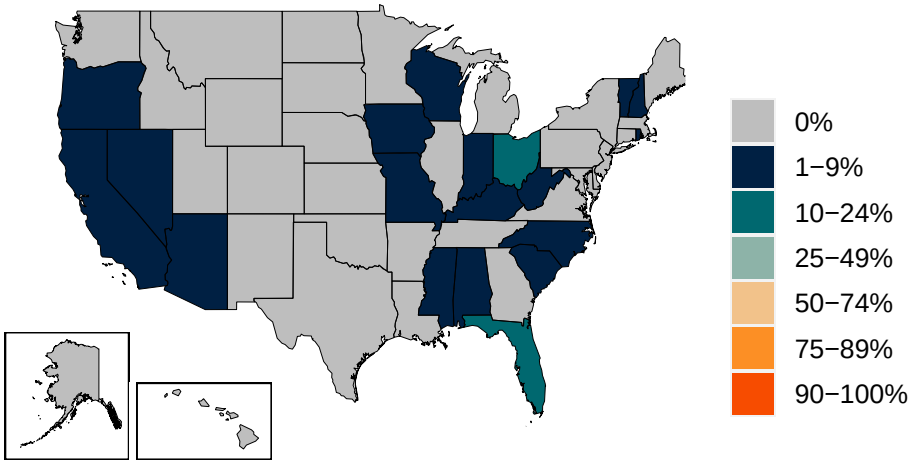
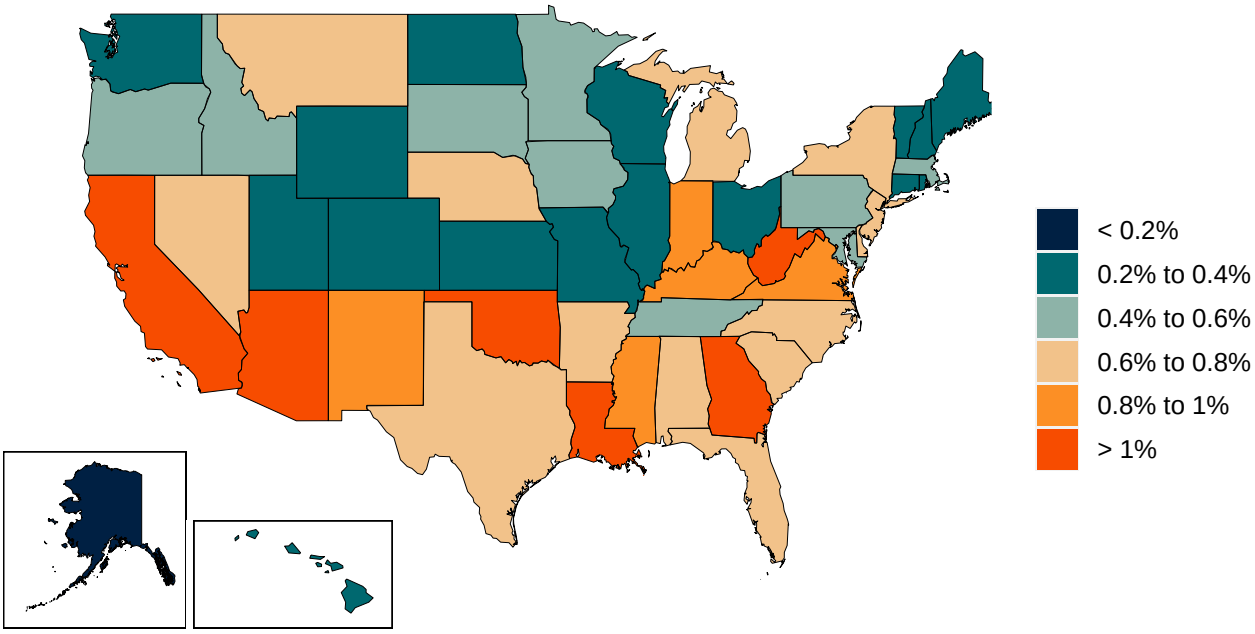


Figure 8. Infection fatality ratio on April 12, 2021. This is estimated as the ratio of COVID-19 deaths to infections based on the SEIR disease transmission model.



Critical drivers

Table 2. Current mandate implementation

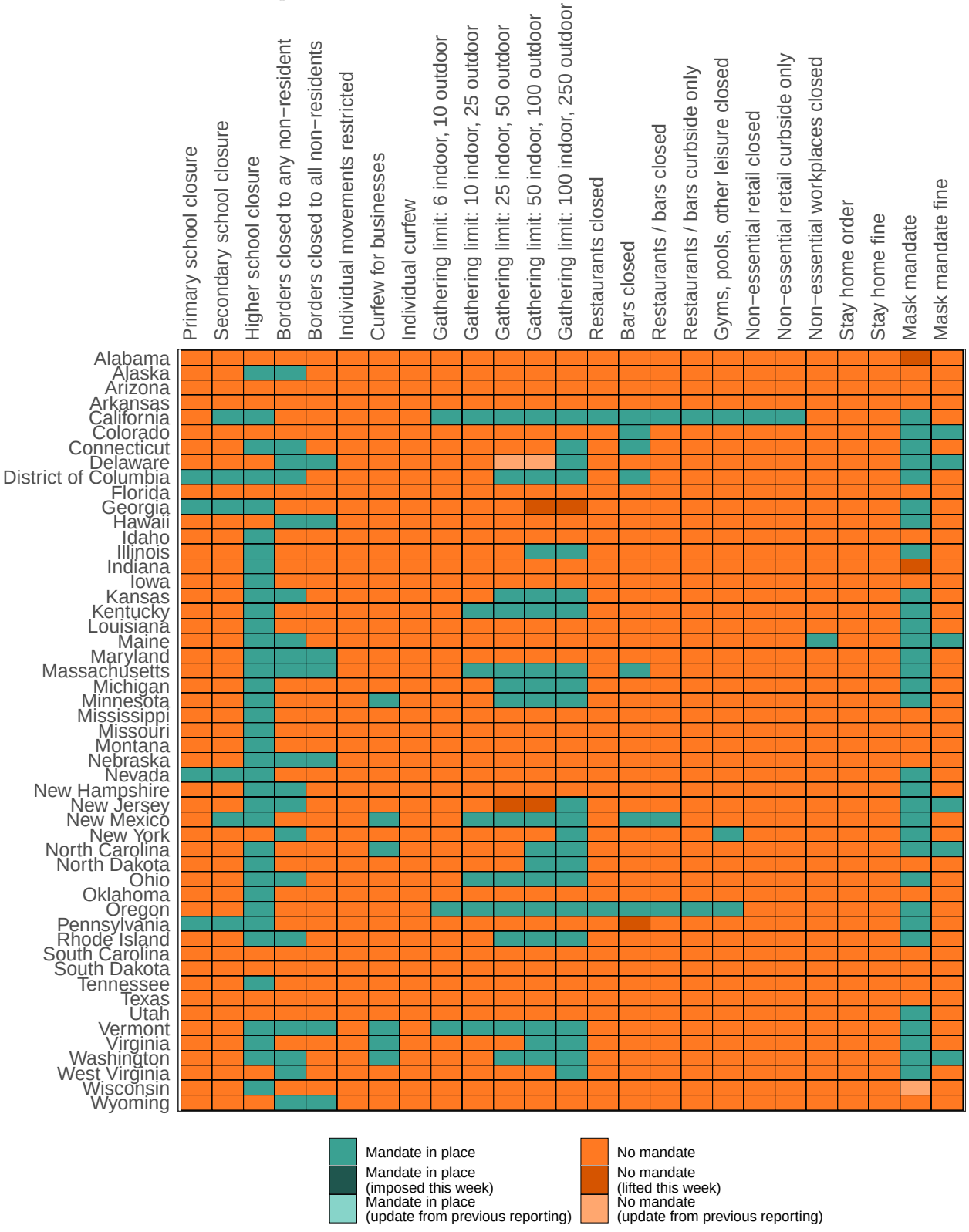


Figure 9. Trend in mobility as measured through smartphone app use compared to January 2020 baseline

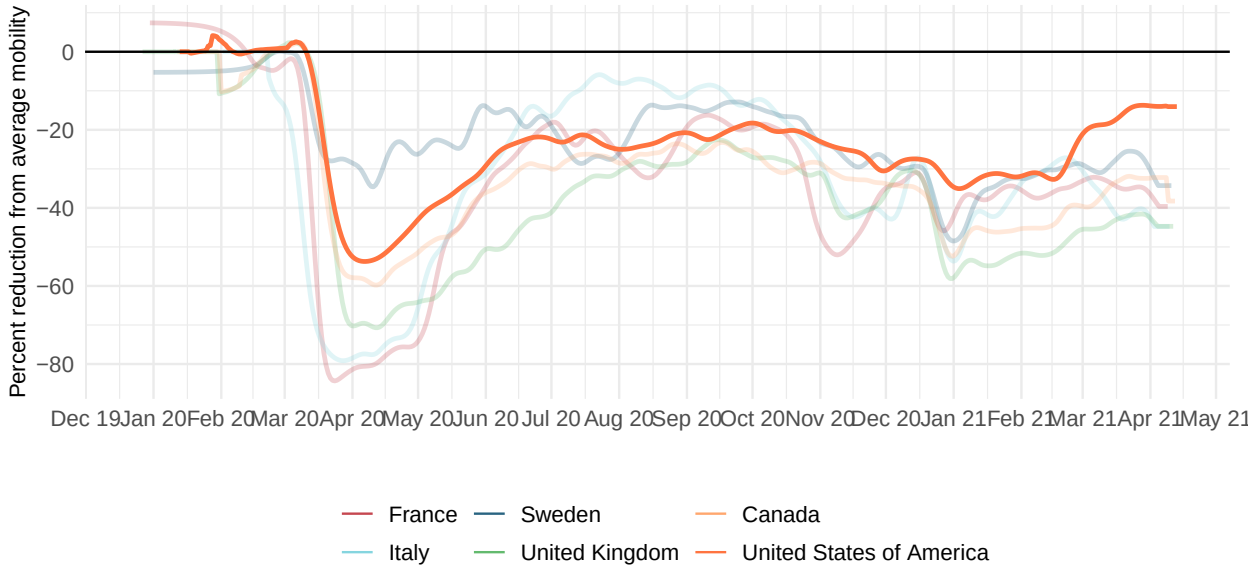


Figure 10. Mobility level as measured through smartphone app use compared to January 2020 baseline (percent) on April 12, 2021

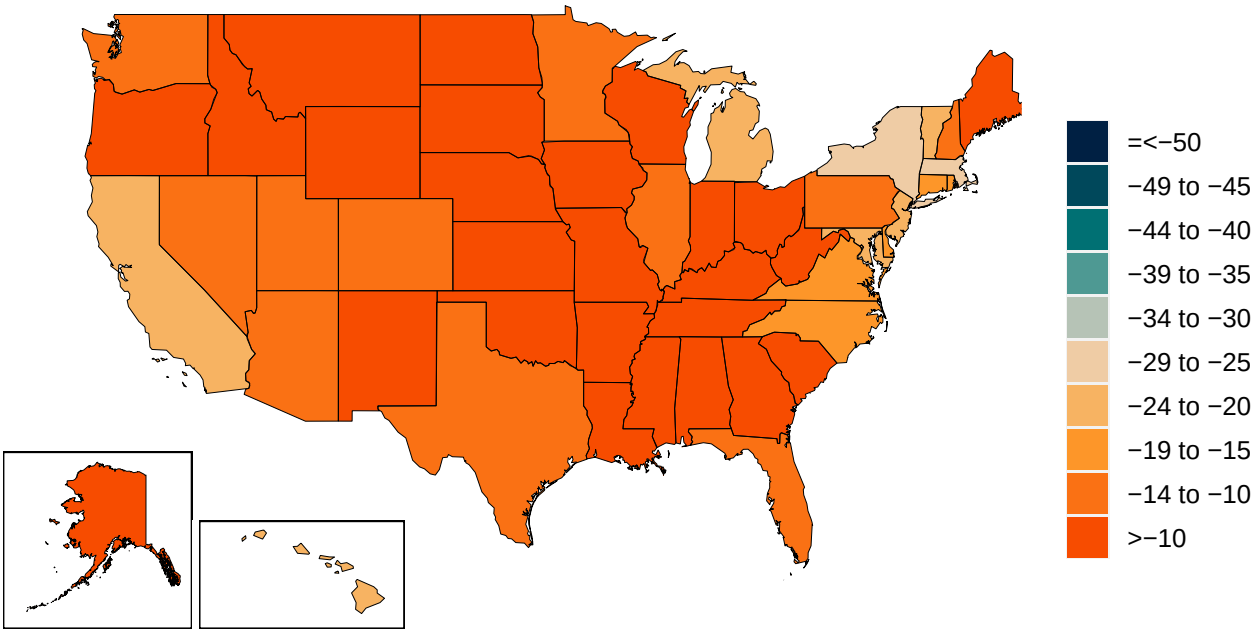


Figure 11. Trend in the proportion of the population reporting always wearing a mask when leaving home

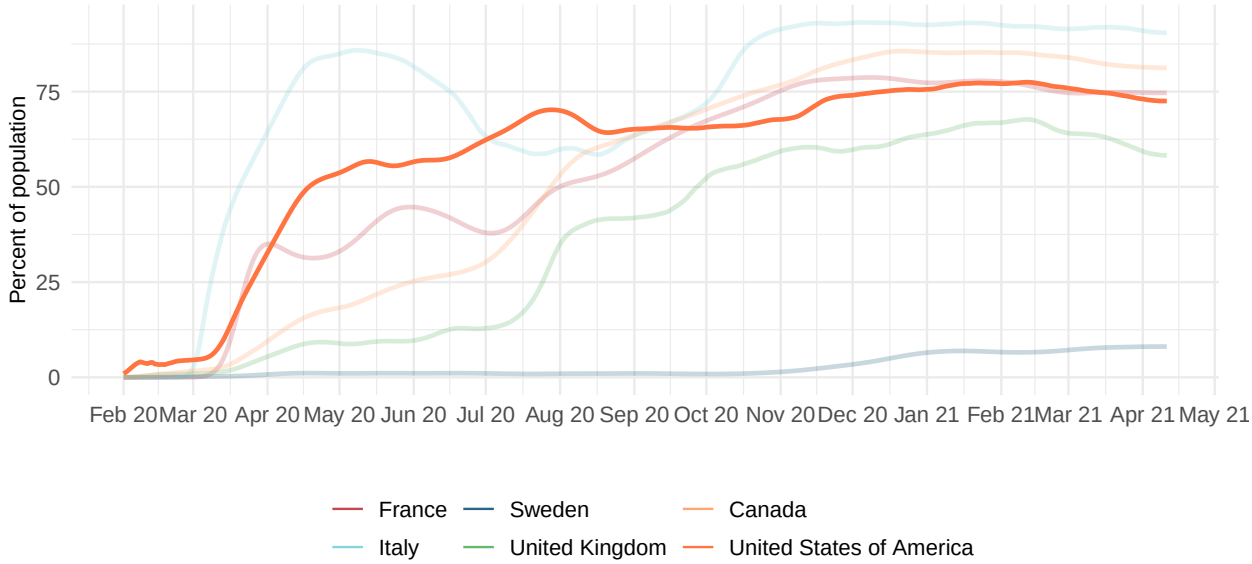


Figure 12. Proportion of the population reporting always wearing a mask when leaving home on April 12, 2021

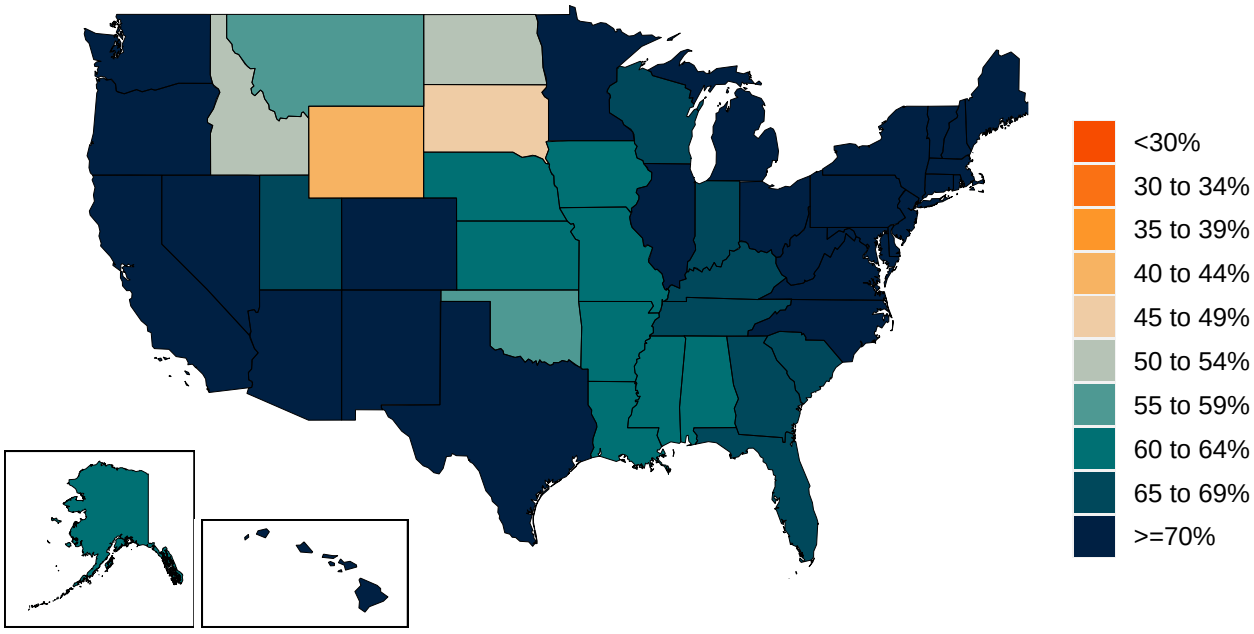


Figure 13. Trend in COVID-19 diagnostic tests per 100,000 people

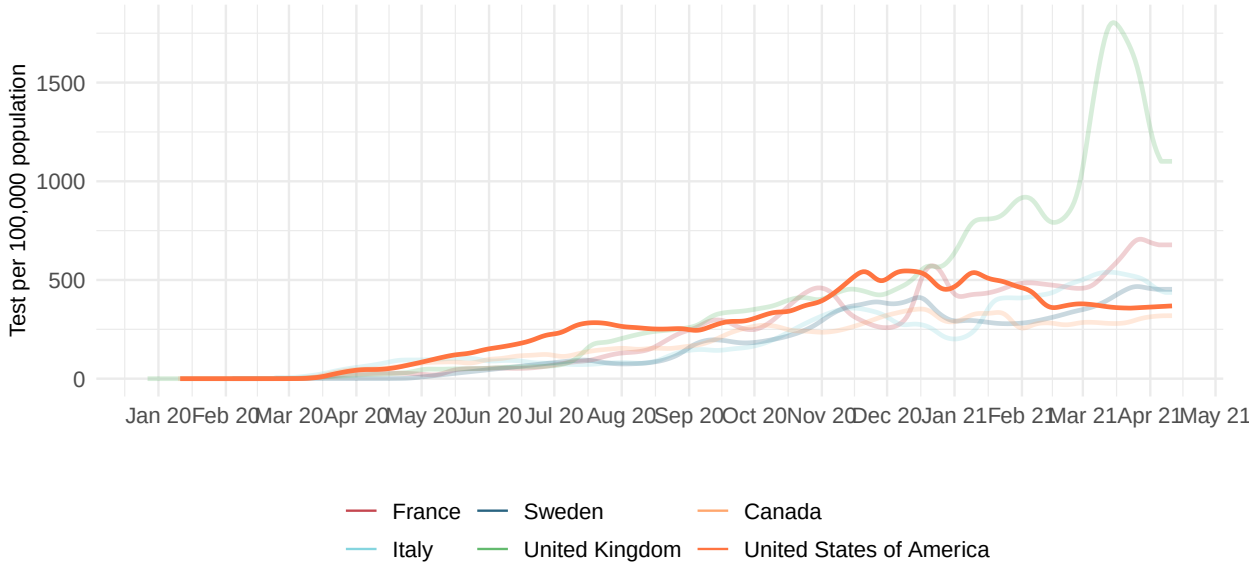


Figure 14. COVID-19 diagnostic tests per 100,000 people on March 23, 2021

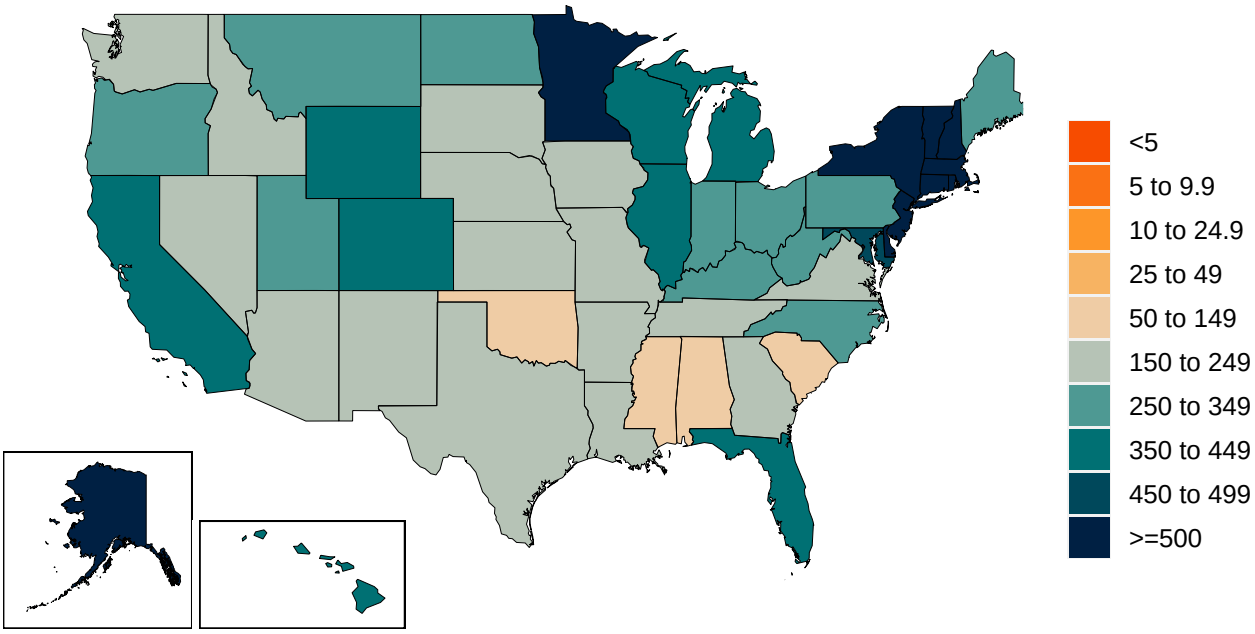


Figure 15. Increase in the risk of death due to pneumonia on February 1 2020 compared to August 1 2020

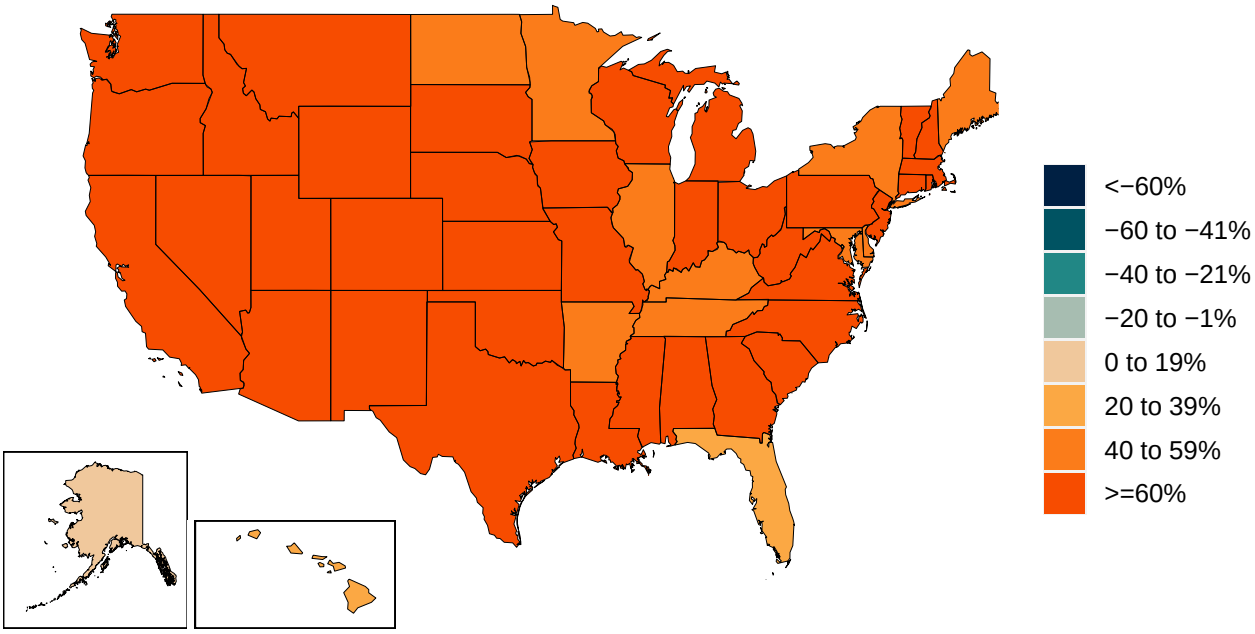


Table 3. The SEIR model uses variant-specific estimates of vaccine efficacy at preventing symptomatic disease and at preventing infection. We use data from clinical trials directly, where available, and make estimates otherwise. More information can be found on our website (http://www.healthdata.org/node/8584).

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 & P.1	Efficacy at preventing infection: B.1.351 & P.1
AstraZeneca	75%	52%	10%	6%
CoronaVac	50%	43%	38%	25%
Janssen	72%	72%	64%	42%
Moderna	94%	85%	72%	47%
Novavax	89%	77%	49%	32%
Pfizer/BioNTech	91%	86%	69%	45%
Sinopharm	73%	63%	56%	36%
Sputnik-V	92%	80%	70%	45%
Tianjin CanSino	66%	57%	50%	32%
Other vaccines	75%	65%	57%	37%
Other vaccines (mRNA)	95%	83%	72%	47%

Figure 16. Trend in the estimated proportion of the adult (18+) population that have been vaccinated or is open to receiving a COVID-19 vaccine based on Facebook survey responses (yes and yes, probably).

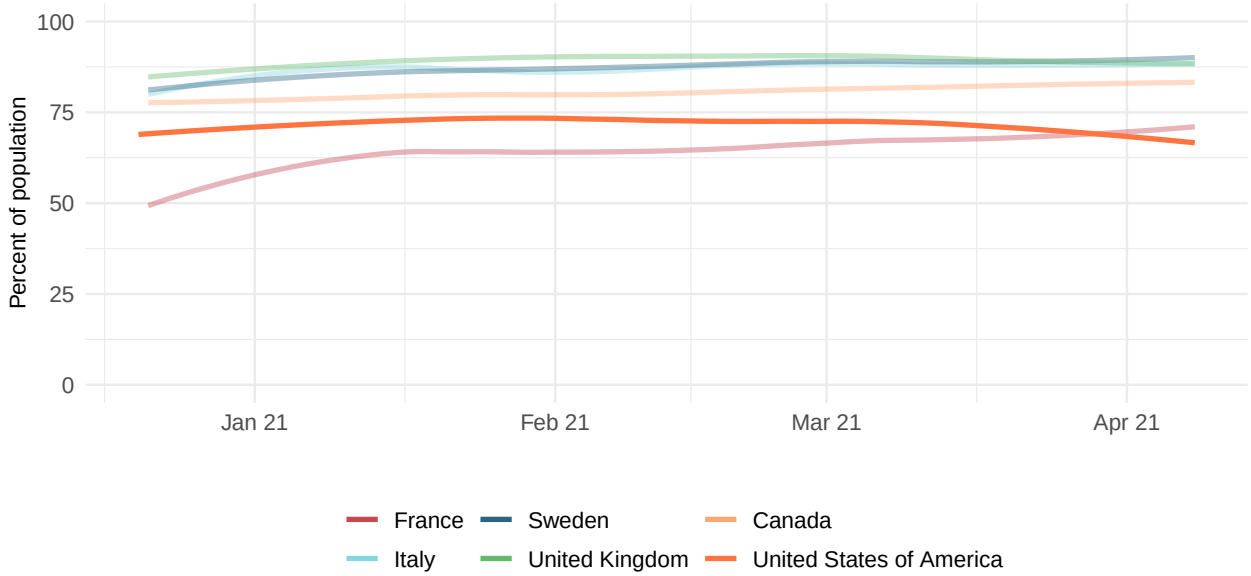


Figure 17. This figure shows the estimated proportion of the adult (18+) population that has been vaccinated or is open to receiving a COVID-19 vaccine based on Facebook survey responses (yes and yes, probably).

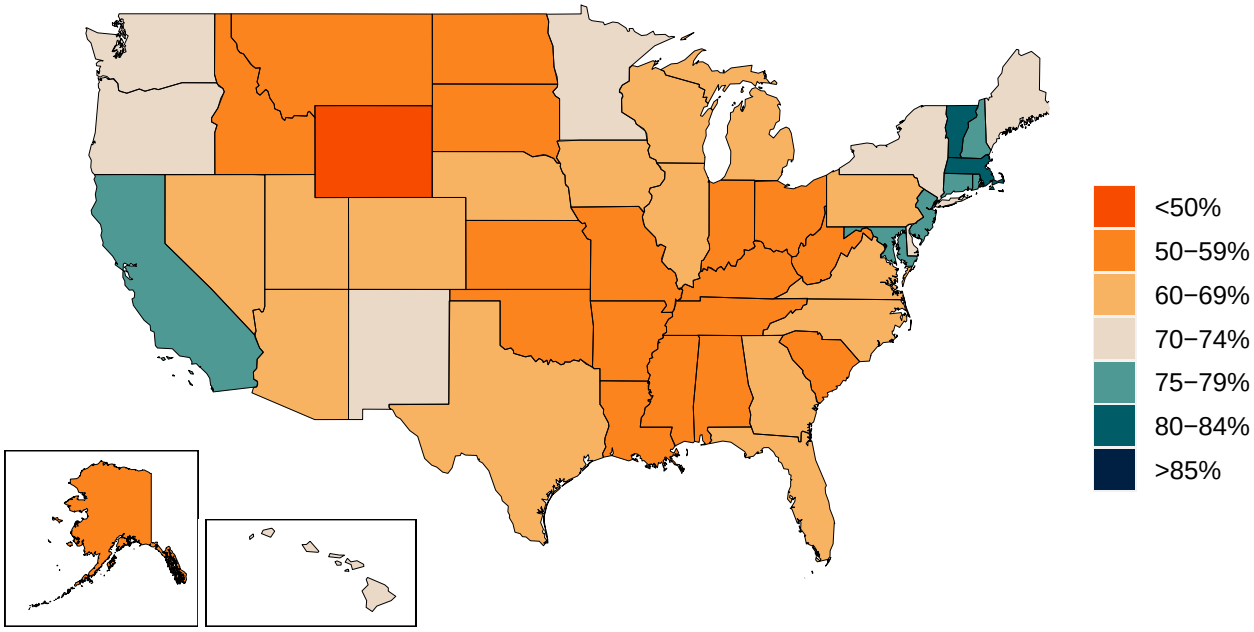
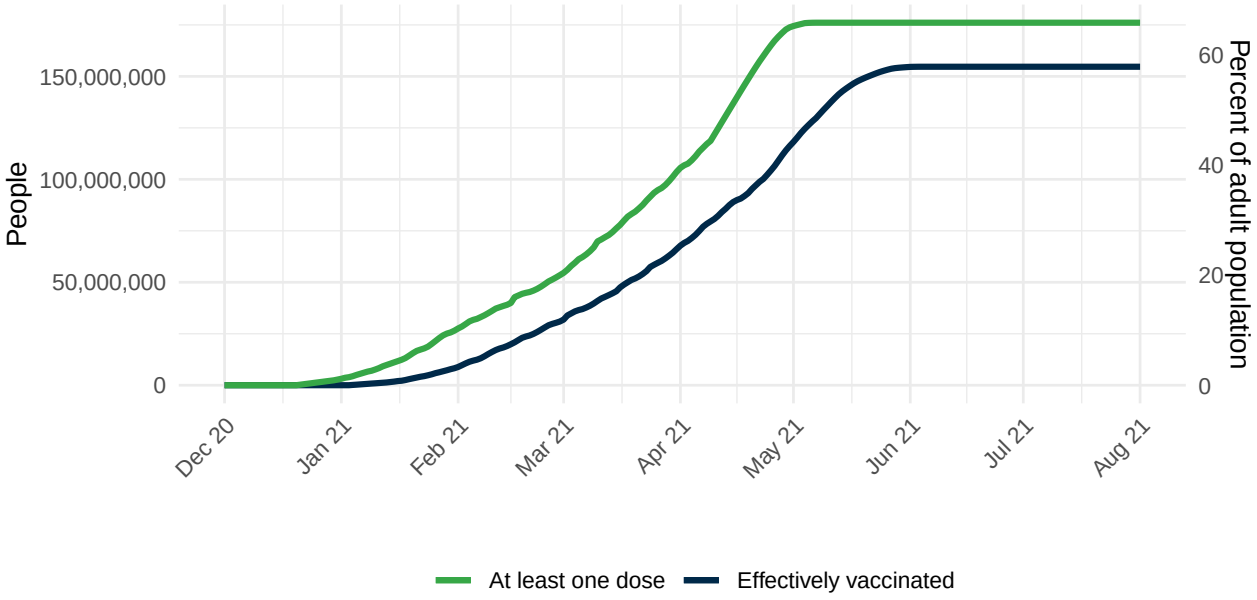


Figure 18. The number of people who receive any vaccine and those who are effectively vaccinated and protected against disease, accounting for efficacy, loss to follow up for two-dose vaccines, partial immunity after one dose, and immunity after two doses.



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 19. Cumulative COVID-19 deaths until August 01, 2021 for three scenarios

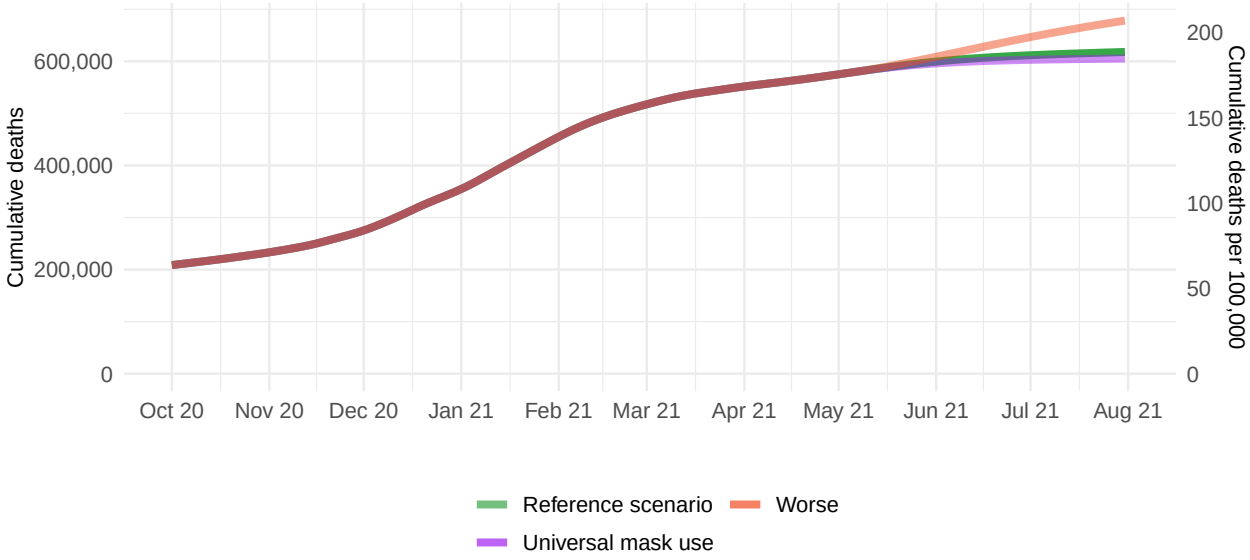


Figure 20. Daily COVID-19 deaths until August 01, 2021 for three scenarios,

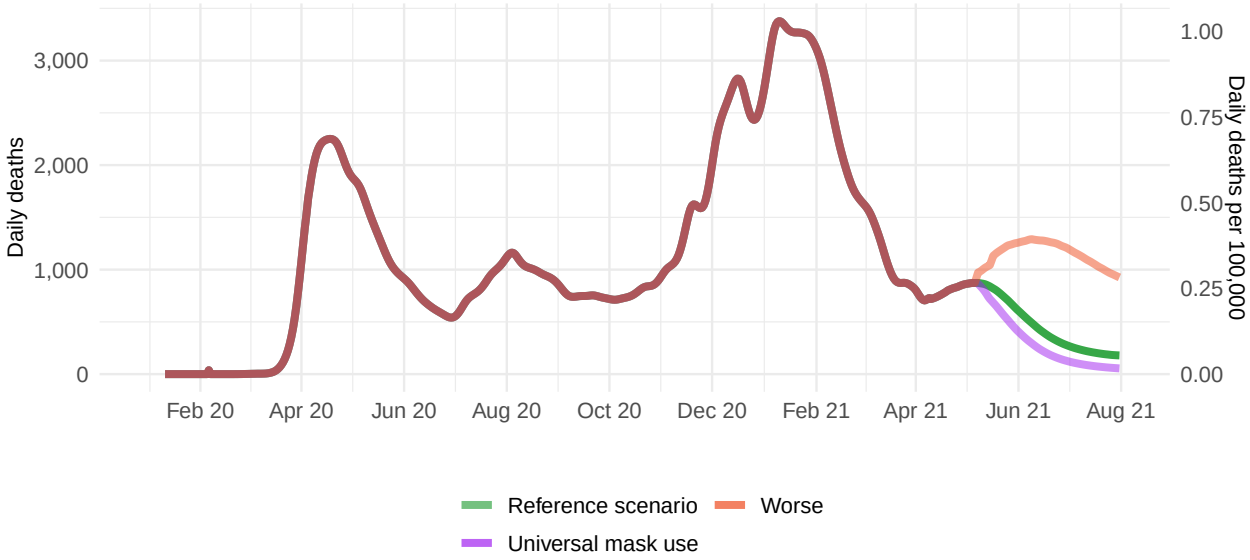


Figure 21. Daily COVID-19 infections until August 01, 2021 for three scenarios.

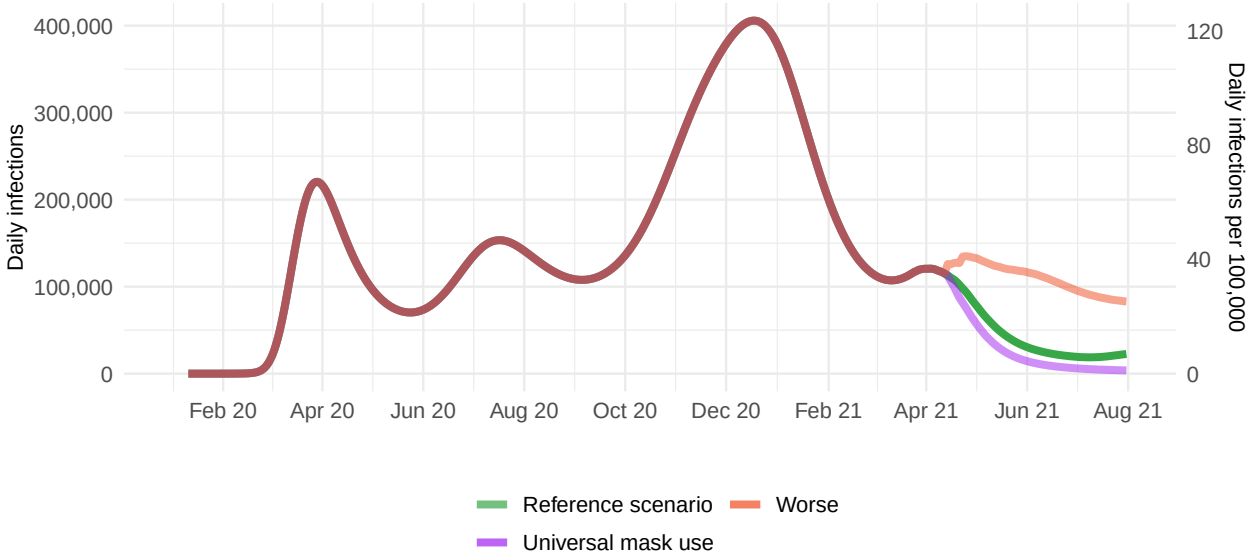


Figure 22. Comparison of reference model projections with other COVID modeling groups. For this comparison, we are including projections of daily COVID-19 deaths from other modeling groups when available: Delphi from the Massachussets Institute of Technology (Delphi; https://www.covidanalytics.io/home), 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 availble locations in that region.

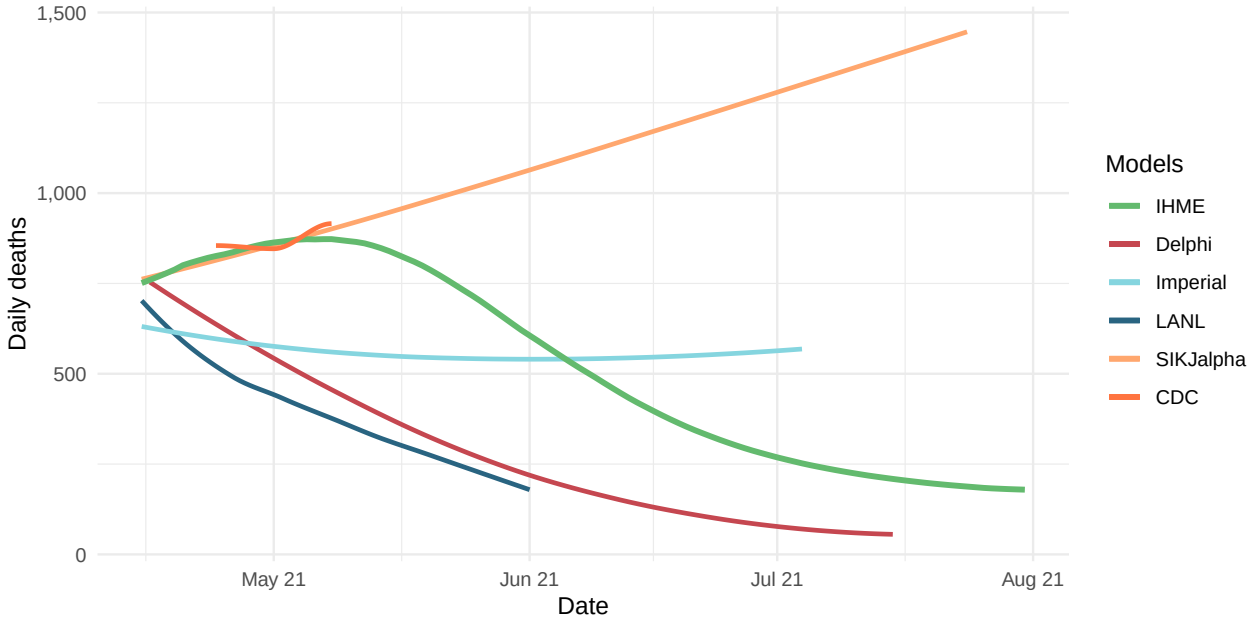


Figure 23. The estimated inpatient hospital usage is shown over time. The percent of hospital beds occupied by COVID-19 patients is color coded based on observed quantiles of the maximum proportion of beds occupied by COVID-19 patients. Less than 5% is considered *low stress*, 5-9% is considered *moderate stress*, 10-19% is considered *high stress*, and greater than 20% is considered *extreme stress*.

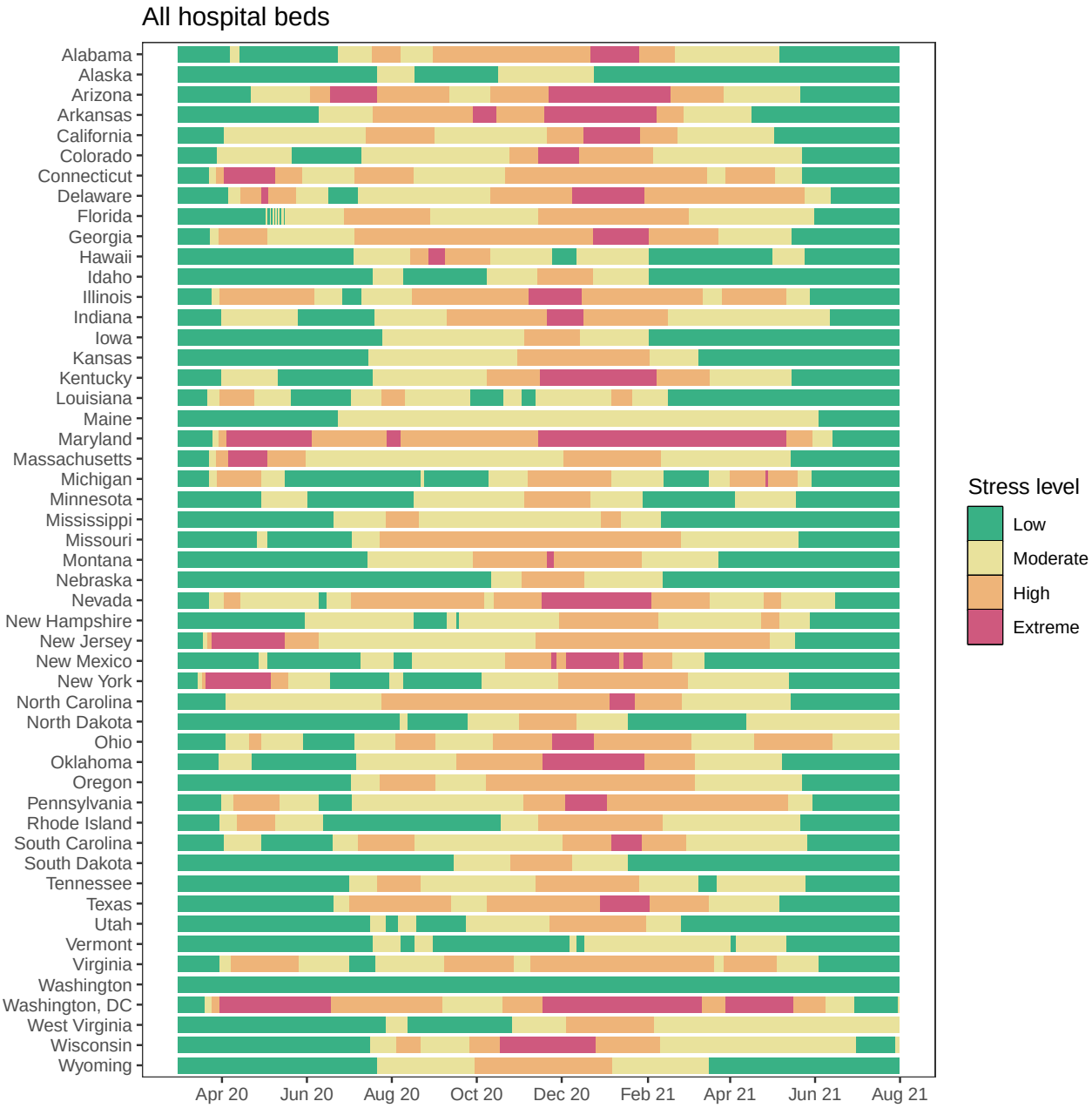
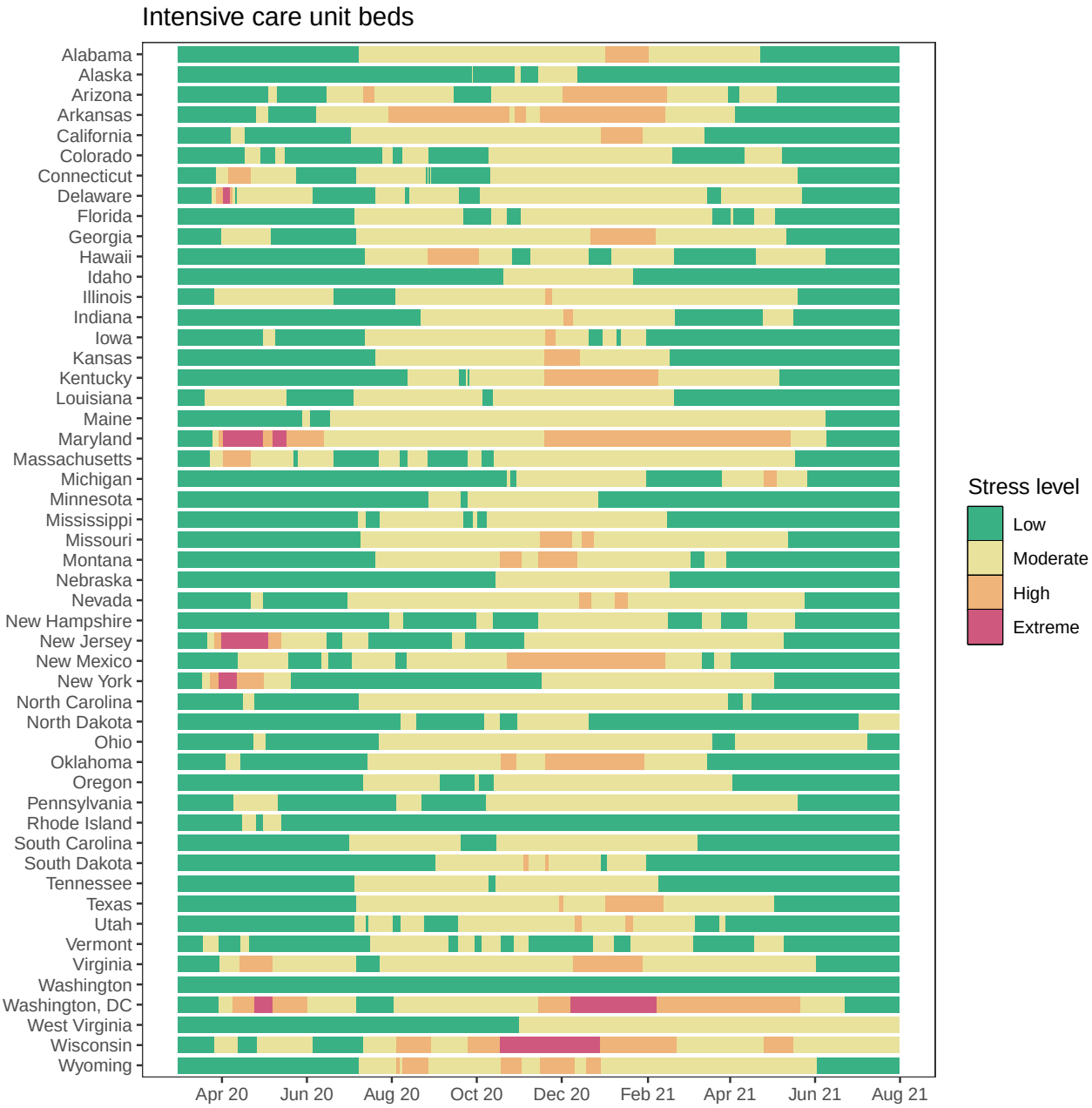


Figure 24. The estimated intensive care unit (ICU) usage is shown over time. The percent of ICU beds occupied by COVID-19 patients is color coded based on observed quantiles of the maximum proportion of ICU beds occupied by COVID-19 patients. Less than 10% is considered *low stress*, 10-29% is considered *moderate stress*, 30-59% is considered *high stress*, and greater than 60% is considered *extreme stress*.



More information

Data sources:

Mask use data sources include Premise; Facebook Global Symptom Survey (This research is based on survey results from University of Maryland Social Data Science Center) and the Facebook United States Symptom Survey (in collaboration with Carnegie Mellon University); Kaiser Family Foundation; YouGov COVID-19 Behaviour Tracker survey.

Vaccine hesitancy data are from the COVID-19 Beliefs, Behaviors, and Norms Study, a survey conducted on Facebook by the Massachusetts Institute of Technology (https://covidsurvey.mit.edu/).

Vaccine hesitancy data are from the Facebook Global Symptom Survey (This research is based on survey results from University of Maryland Social Data Science Center), the Facebook United States Symptom Survey (in collaboration with Carnegie Mellon University), and from the Facebook COVID-19 Beliefs, Behaviors, and Norms Study conducted by the Massachusetts Institute of Technology.

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.