COVID-19 Results Briefing

The United States of America

April 08, 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 6, 2021, with data through April 5, 2021.

Daily cases increased 9% over the last week while daily deaths decreased. The national averages mask that in more than half of the states, transmission is increasing. The largest surge has been in Michigan, where daily cases have increased over 500% in the last month and deaths are beginning to increase. The surge in Michigan cannot be explained fully by mobility, mask use, or B.1.1.7 spread; some other factors must be driving up transmission. The trend in the next two months will depend on the balance of increased vaccination, variant spread, particularly of escape variants, and the behavioral response of the public. Mobility is now at the highest level since mid-March 2020, but mask use continues to hover around 75%. In our reference scenario, we expect daily deaths to begin declining in early to mid-March and drop to below 250 a day in July. However, somewhat faster declines in mask use and increases in mobility captured in our worse scenario can lead to daily deaths increasing to over 1,250 a day at the beginning of June and remaining over 750 a day by August 1. Worse trajectories can be constructed if escape variants (B.1.351 and P1) spread faster and if individuals rush to return back to pre-COVID-19 behavior patterns. The main strategies to pursue are scaling up vaccination, maintaining mask use, and avoiding premature reopening. Continued slow declines in vaccine confidence may limit the ultimate effect of vaccination on transmission.

Current situation

- Daily reported cases in the last week increased to 63,400 per day on average compared to 58,600 the week before (Figure 1).
- Daily deaths in the last week decreased to 870 per day on average compared to 950 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 Kentucky, Massachusetts, New York, and Ohio (Figure 3).
- We estimated that 21% of people in the US have been infected as of April 5 (Figure 4).
- Effective R, computed using cases, hospitalizations, and deaths, is greater than 1 in 28 states (Figure 5).
- The infection detection rate in the US is over 50% (Figure 6).

- Analysis of CDC and GISAID sequence data combined with our variant spread model provides estimates of current variant prevalence (Figure 7). B.1.1.7 is widely distributed, with the highest prevalence in Maryland, but several states have prevalence rates over 75%. B.1.351 is present in the Southeast and P1 is present in the Southeast and the West Coast.

Trends in drivers of transmission

- Mandates continue to be removed. At this point the main mandates in place in the majority of states are high school closures, mask mandates, and some form of gathering restrictions (Table 2).
- Mobility last week was 13% lower than the pre-COVID-19 baseline, reaching the level last seen in mid-March 2020 (Figure 9). Mobility was near baseline (within 10%) in 27 states.
- Reported mask use remains high. 74% of people always wore a mask when leaving their home (Figure 11). Mask use was lower than 50% in South Dakota and Wyoming.
- There were 376 diagnostic tests per 100,000 people on April 5 (Figure 13).
- In the US, 69.3% 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 54% in Wyoming to 88% in District of Columbia (Figure 17).
- In our current reference scenario, we expect that 183 million will be fully vaccinated by late May, and at that point vaccination will become demand limited (Figure 18).

Projections

- In our **reference scenario**, which represents what we think is most likely to happen, our model projects 619,000 cumulative deaths on August 1, 2021. This represents 64,000 additional deaths from April 5 to August 1 (Figure 19). Daily deaths are expected to decline steadily until August 1 (Figure 20).
- If **universal mask coverage (95%)** were attained in the next week, our model projects 14,000 fewer cumulative deaths compared to the reference scenario on August 1, 2021 (Figure 19).
- Under our **worse scenario**, in which mask use declines more rapidly and mobility increases more quickly, our model projects 698,000 cumulative deaths on August 1, 2021, an additional 79,000 deaths compared to our reference scenario (Figure 19). In the worse scenario, daily deaths would increase until the beginning of June and then decline but remain over 750 a day on August 1.
- By August 1, we project that 78,200 lives will be saved by the projected vaccine rollout.
- Figure 22 compares our reference scenario forecasts to other publicly archived models. Our forecasts and the CDC ensemble suggest stable daily deaths over the next four weeks. Imperial and USC suggest increasing daily deaths albeit at a slow pace. Los Alamos National Labs and MIT suggest steady declines over the next weeks to months.

- At some point from April through August 1, nine states will have high or extreme stress on hospital beds (Figure 23). At some point from April through August 1, three 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

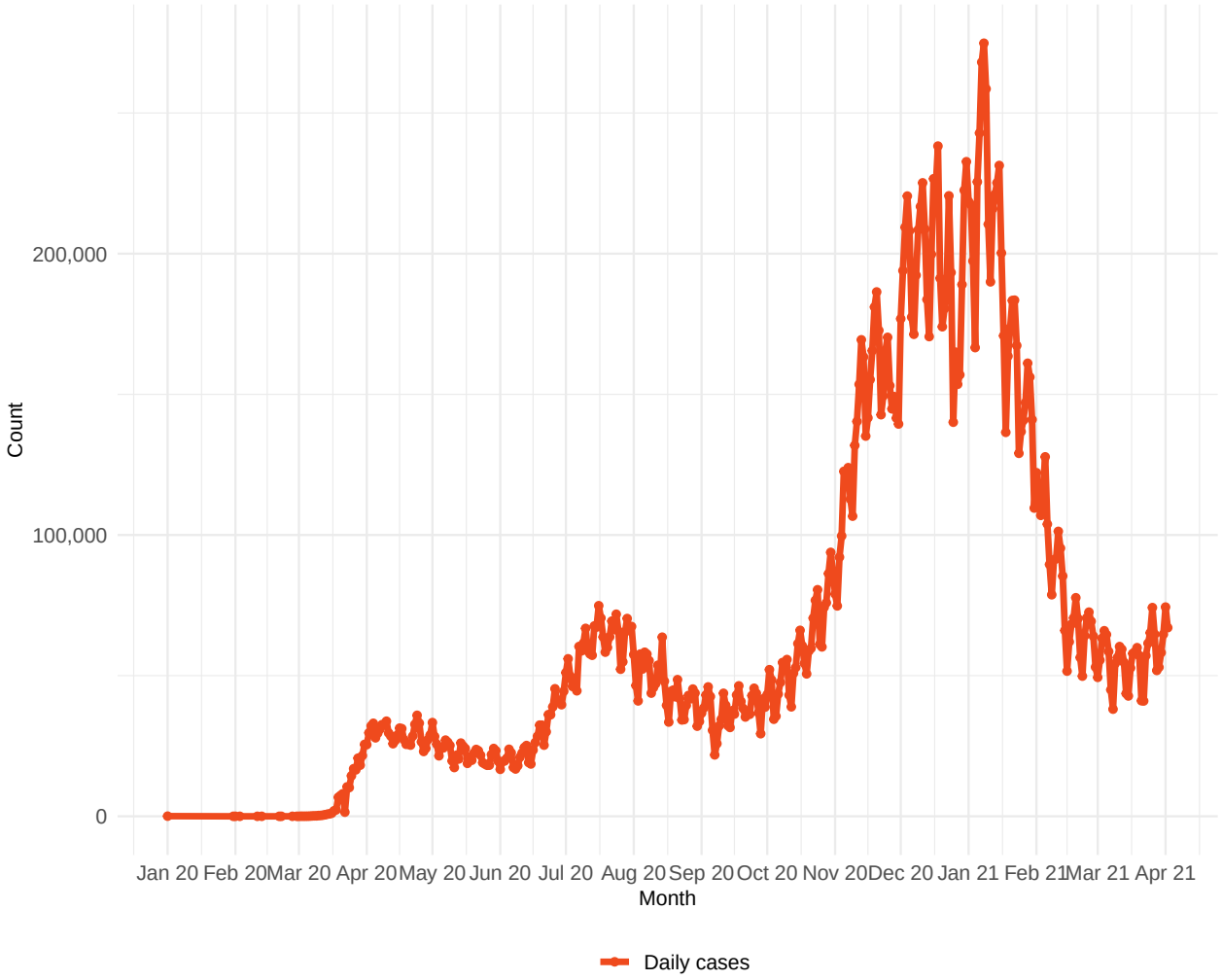


Table 1. Ranking of COVID-19 among the leading causes of mortality this week, assuming uniform deaths of non-COVID causes throughout the year

Cause name	Weekly deaths	Ranking
Ischemic heart disease	10,724	1
COVID-19	6,116	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

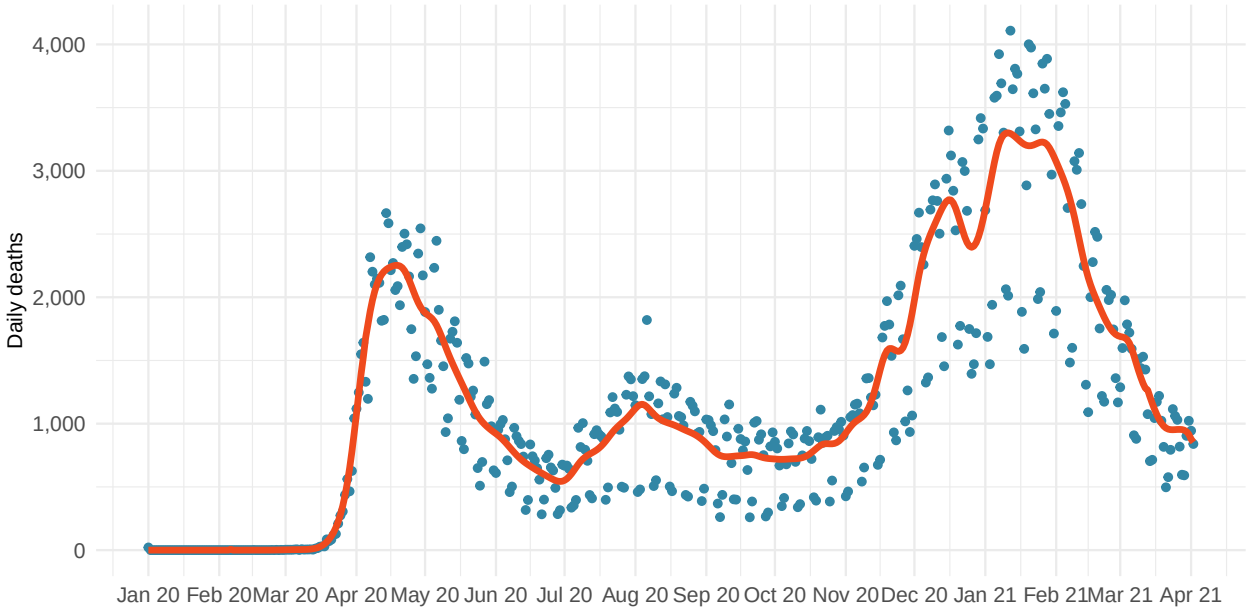


Figure 3. Daily COVID-19 death rate per 1 million on April 05, 2021

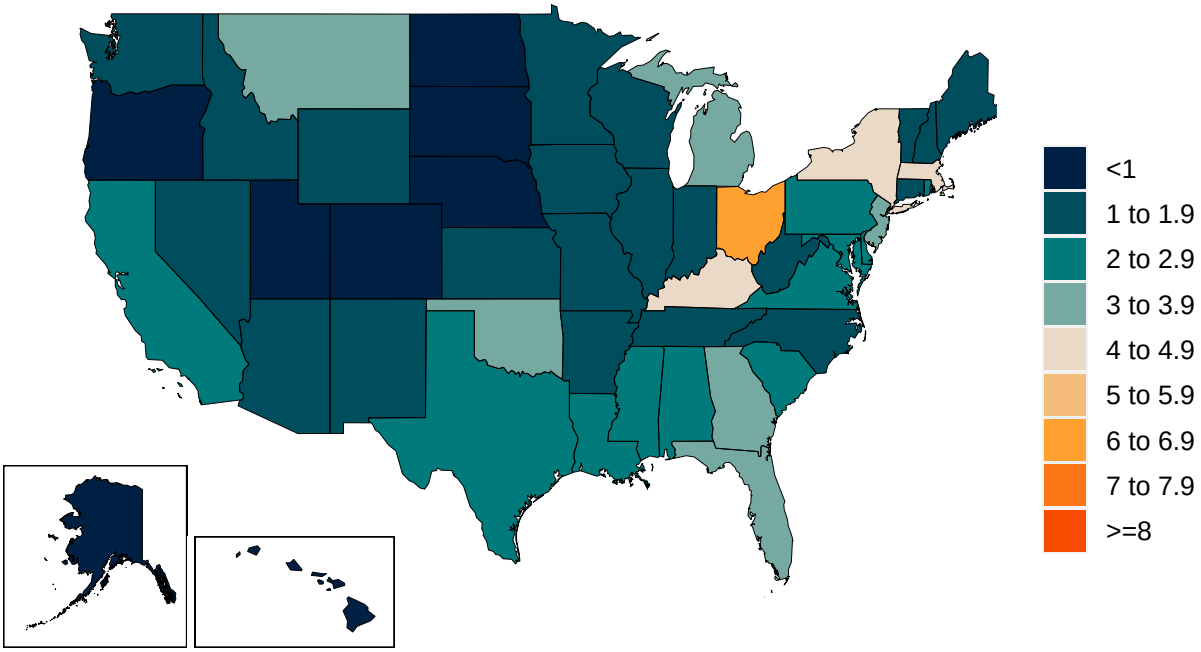


Figure 4. Estimated percent of the population infected with COVID-19 on April 05, 2021

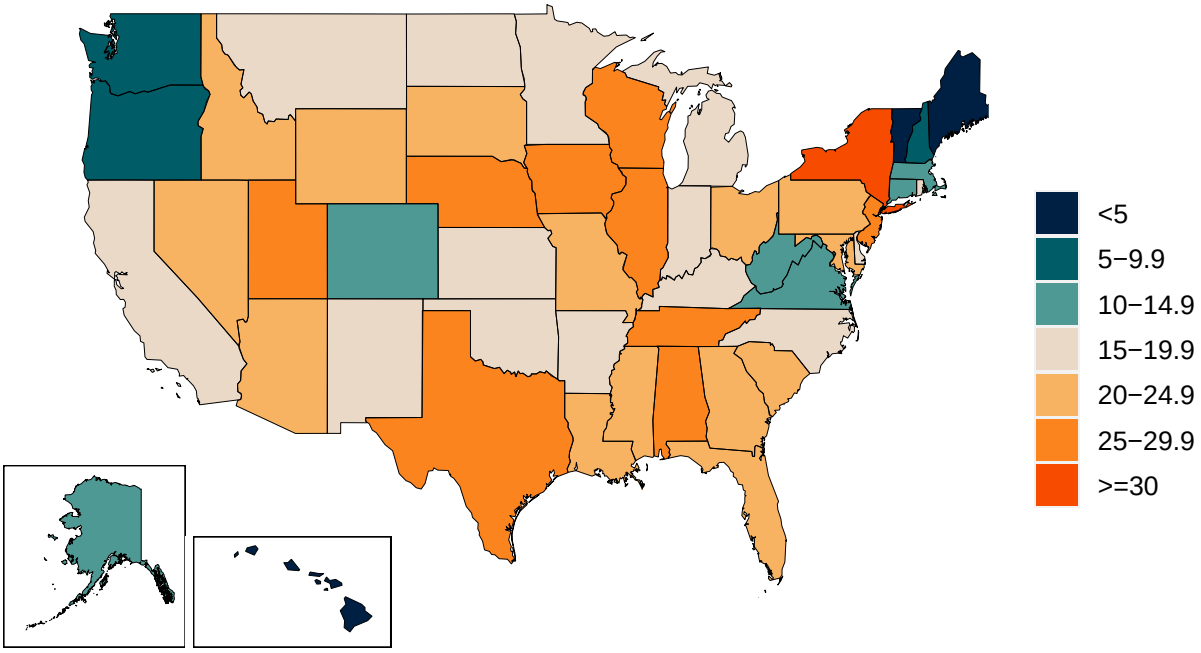


Figure 5. Mean effective R on March 25, 2021. The estimate of effective R is based on the combined analysis of deaths, case reporting, and hospitalizations where available. Current reported cases reflect infections 11-13 days prior, so estimates of effective R can only be made for the recent past. Effective R less than 1 means that transmission should decline, all other things being held the same.

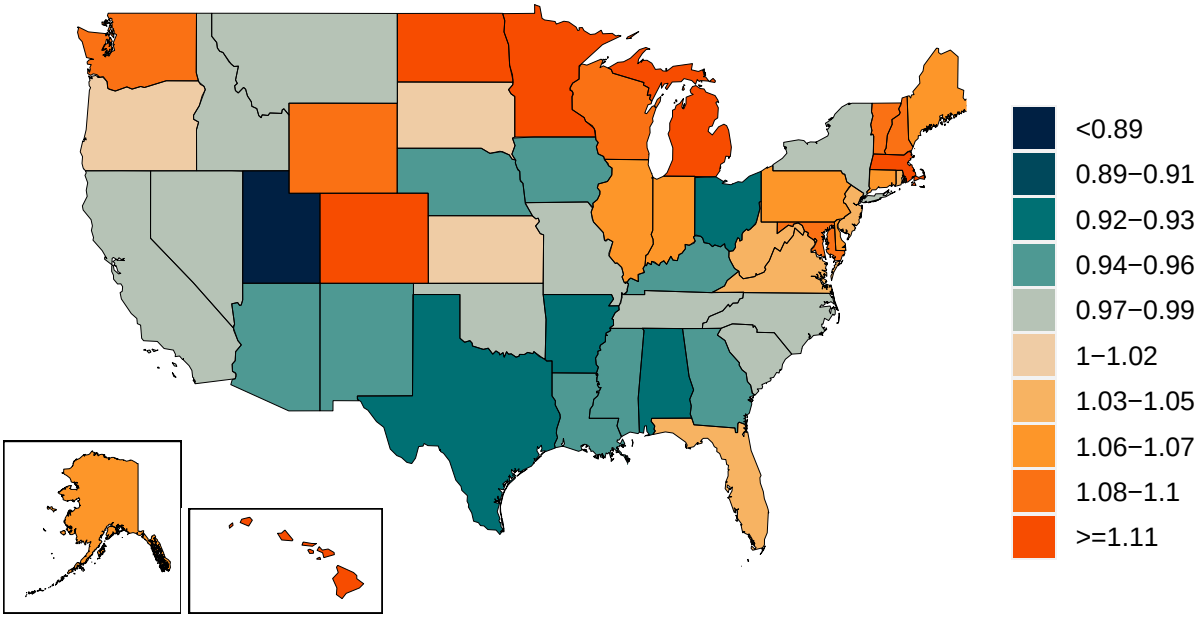
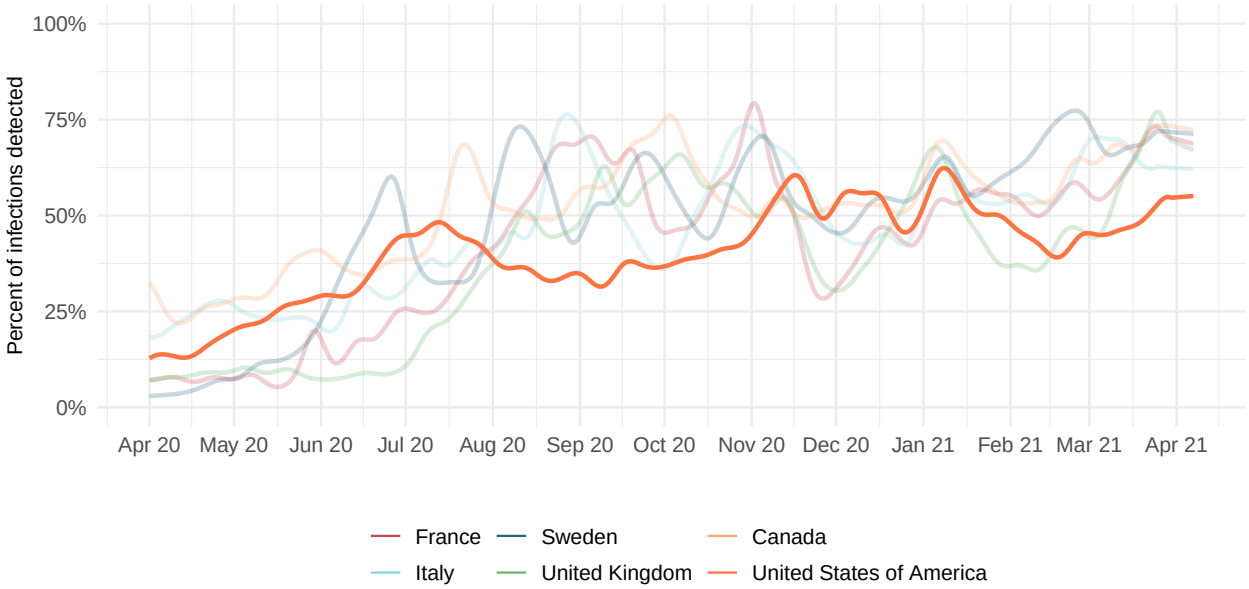


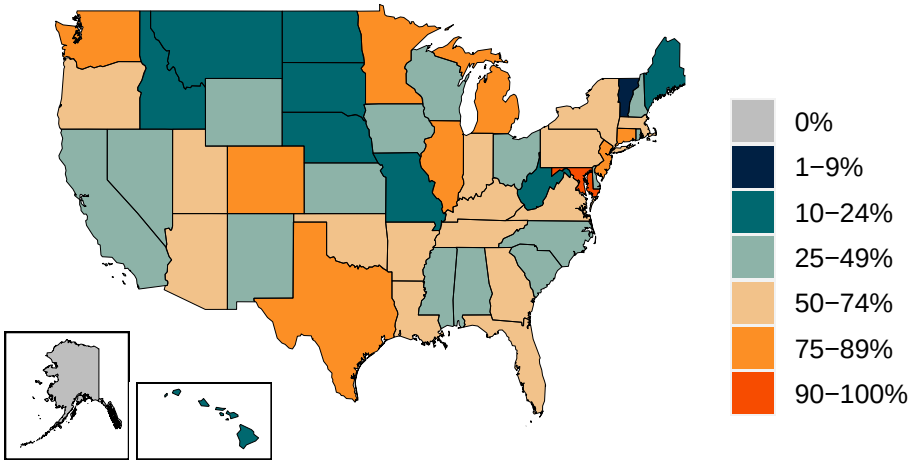
Figure 6. Percent of COVID-19 infections detected. This is estimated as the ratio of reported daily COVID-19 cases to estimated daily COVID-19 infections based on the SEIR disease transmission model.



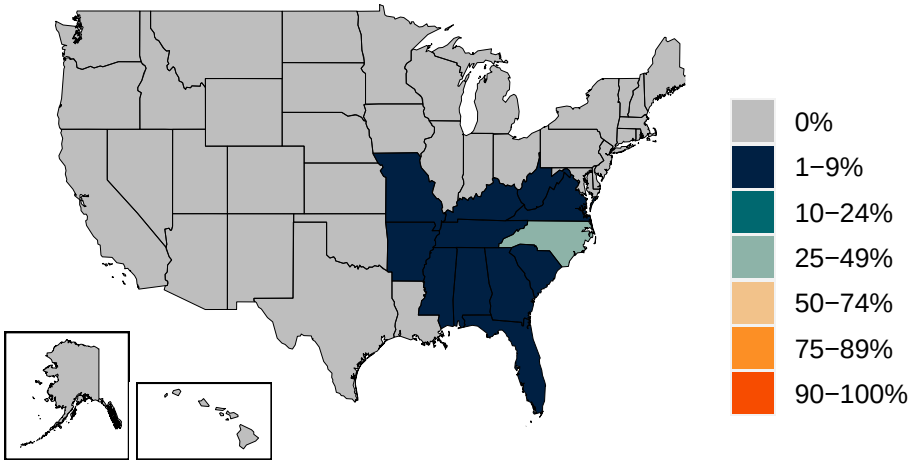
*Due to measurement errors in cases and testing rates, the infection to detection rate (IDR) can exceed 100% at particular points in time.

Figure 7. Percent of circulating SARS-CoV-2 for 3 primary variants on April 5, 2021.

A. Percent B.1.1.7 variant



B. Percent B.1.351 variant



C. Percent P1 variant

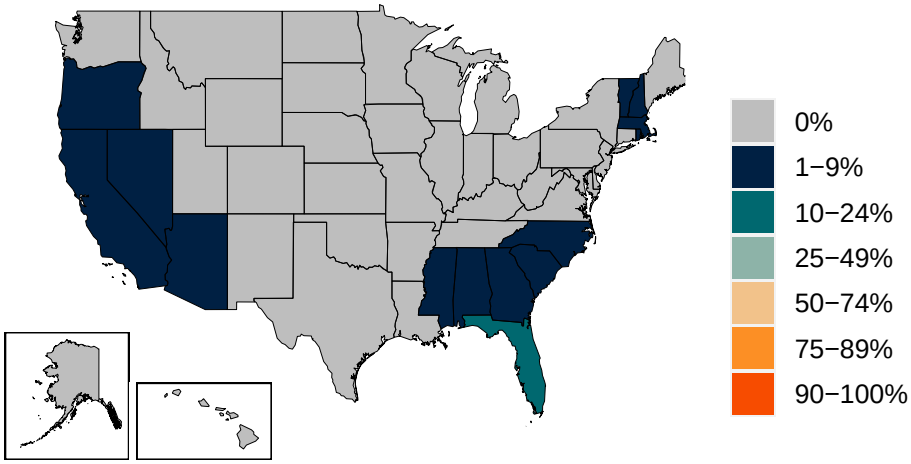
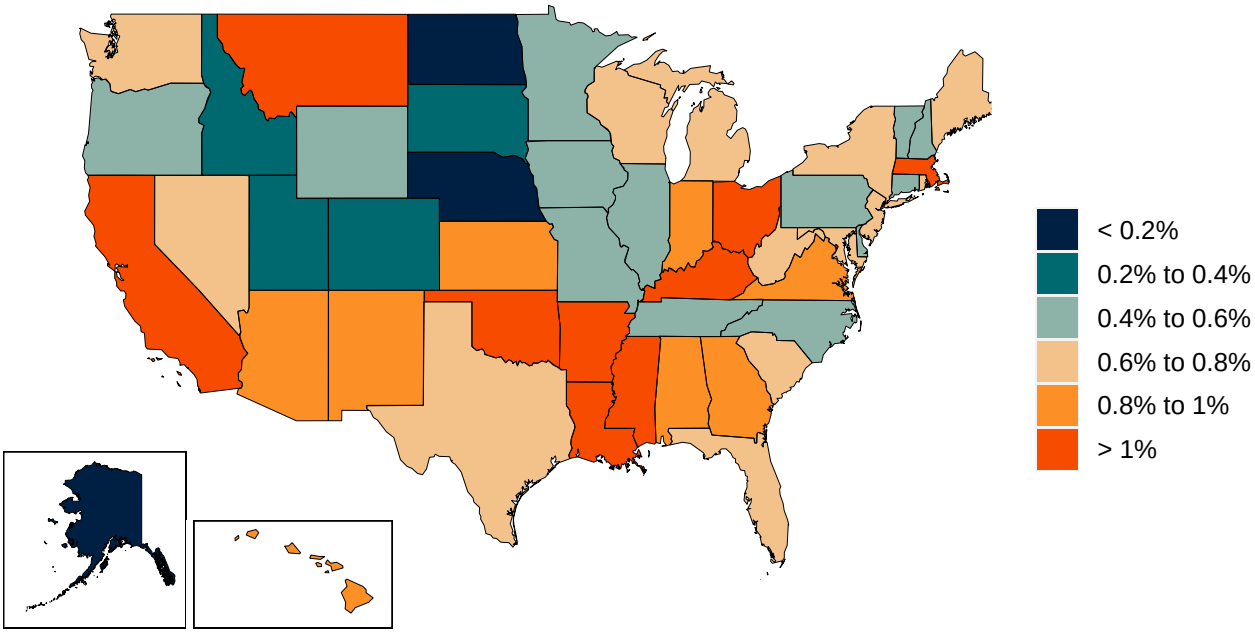


Figure 8. Infection fatality ratio on April 05, 2021. This is estimated as the ratio of COVID-19 deaths to infections based on the SEIR disease transmission model.



Critical drivers

Table 2. Current mandate implementation

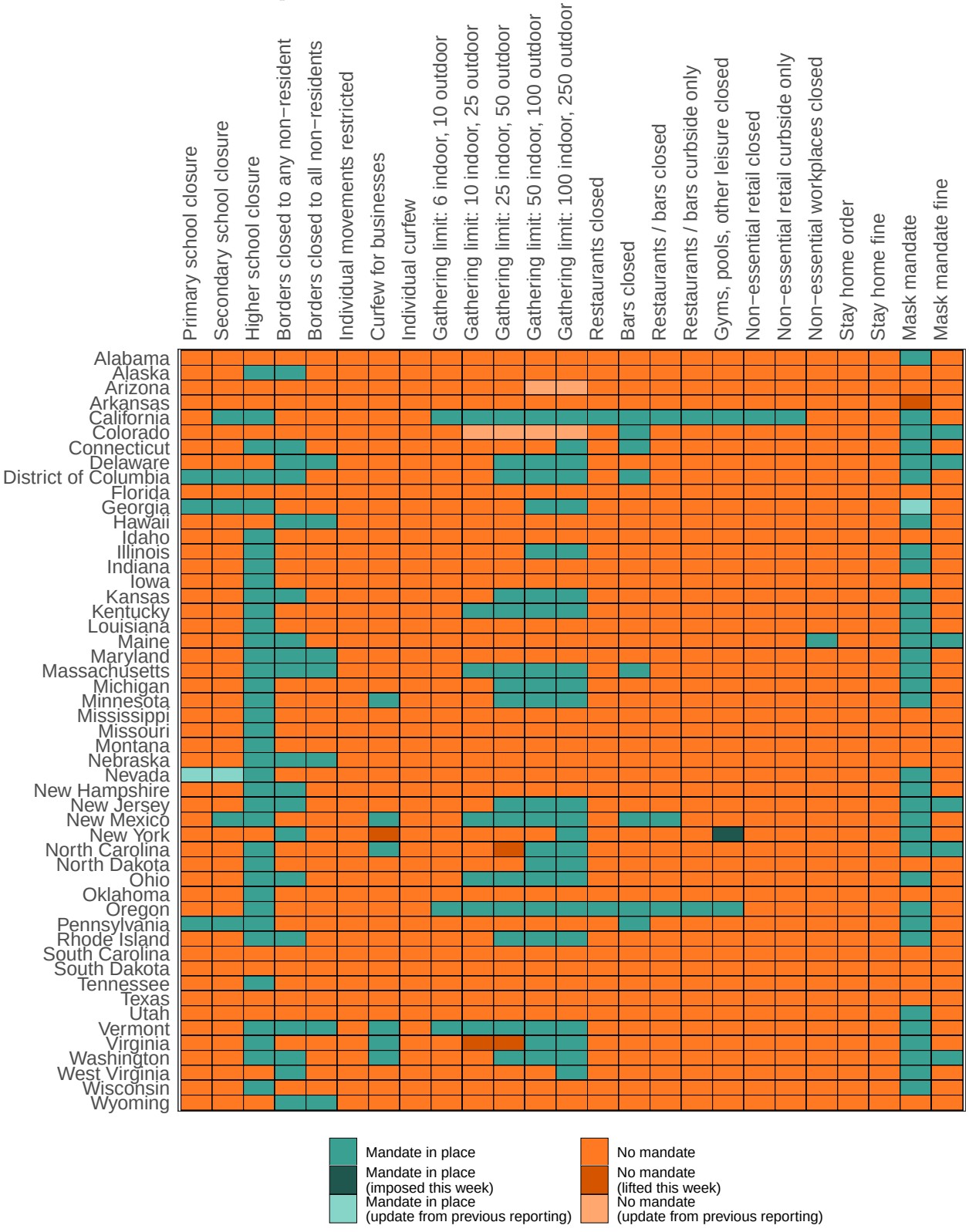


Figure 9. Trend in mobility as measured through smartphone app use compared to January 2020 baseline

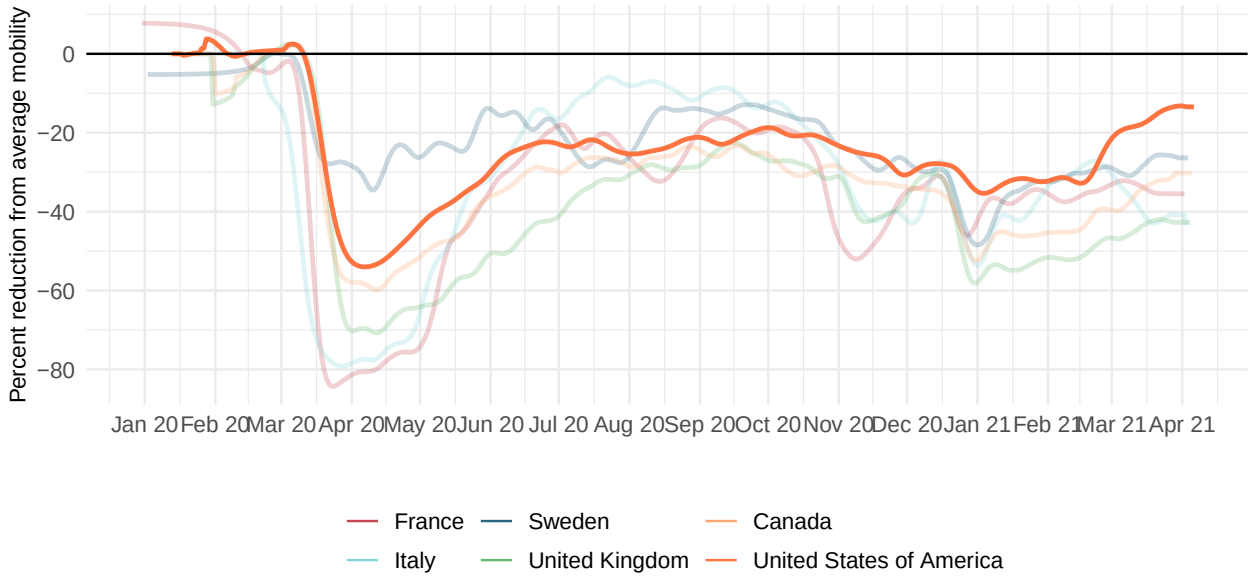


Figure 10. Mobility level as measured through smartphone app use compared to January 2020 baseline (percent) on April 05, 2021

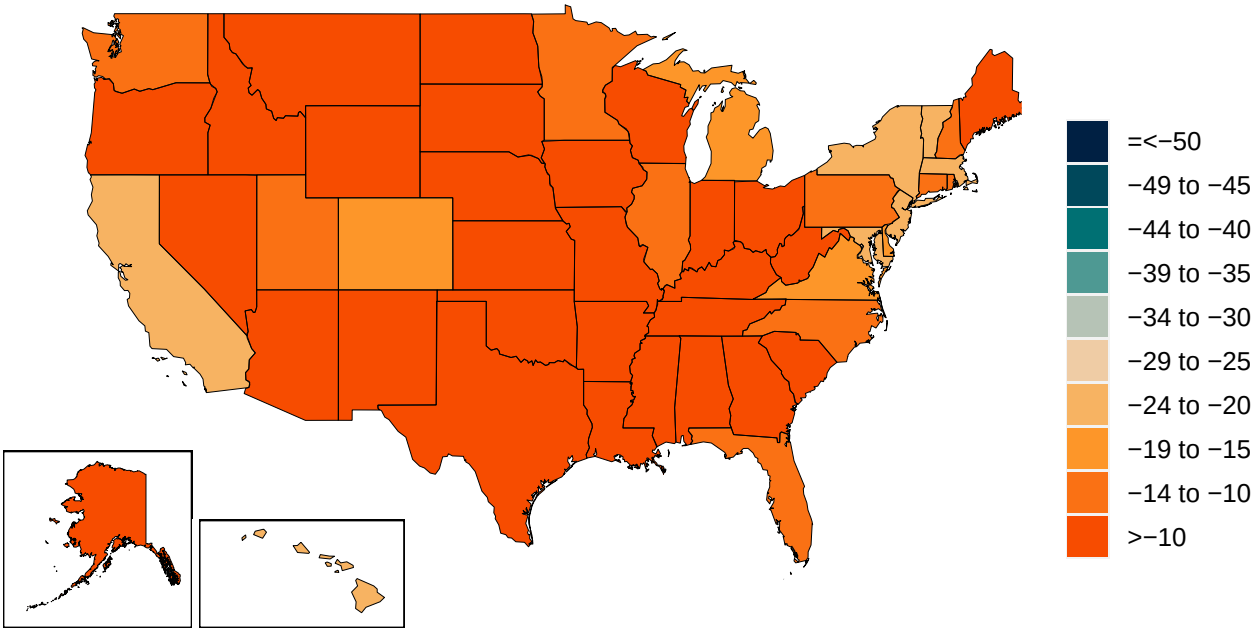


Figure 11. Trend in the proportion of the population reporting always wearing a mask when leaving home

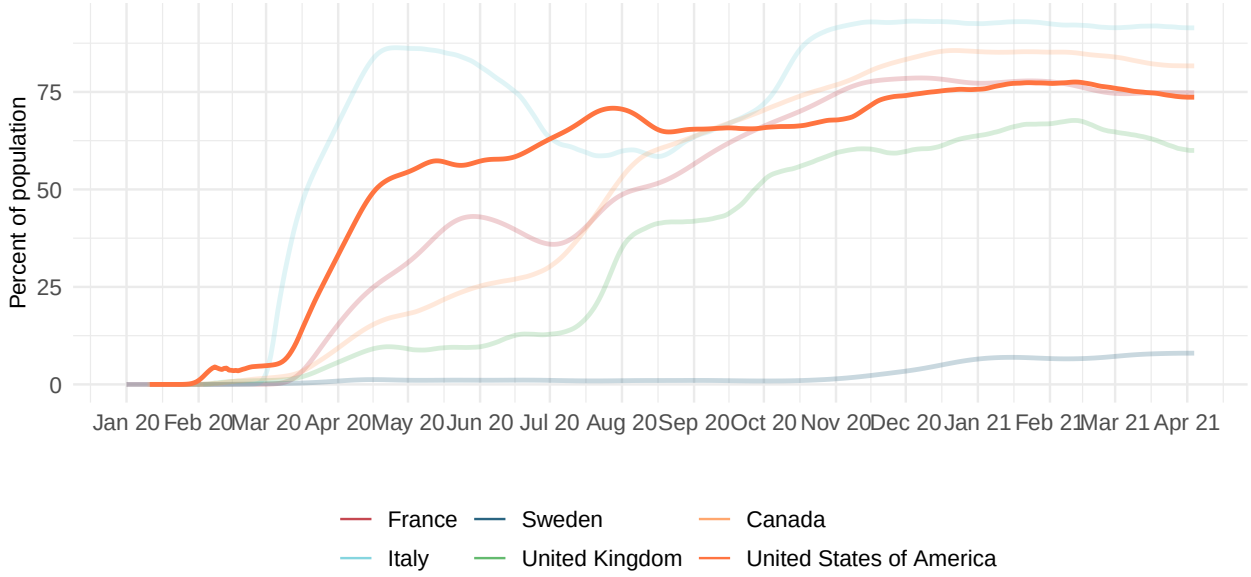


Figure 12. Proportion of the population reporting always wearing a mask when leaving home on April 05, 2021

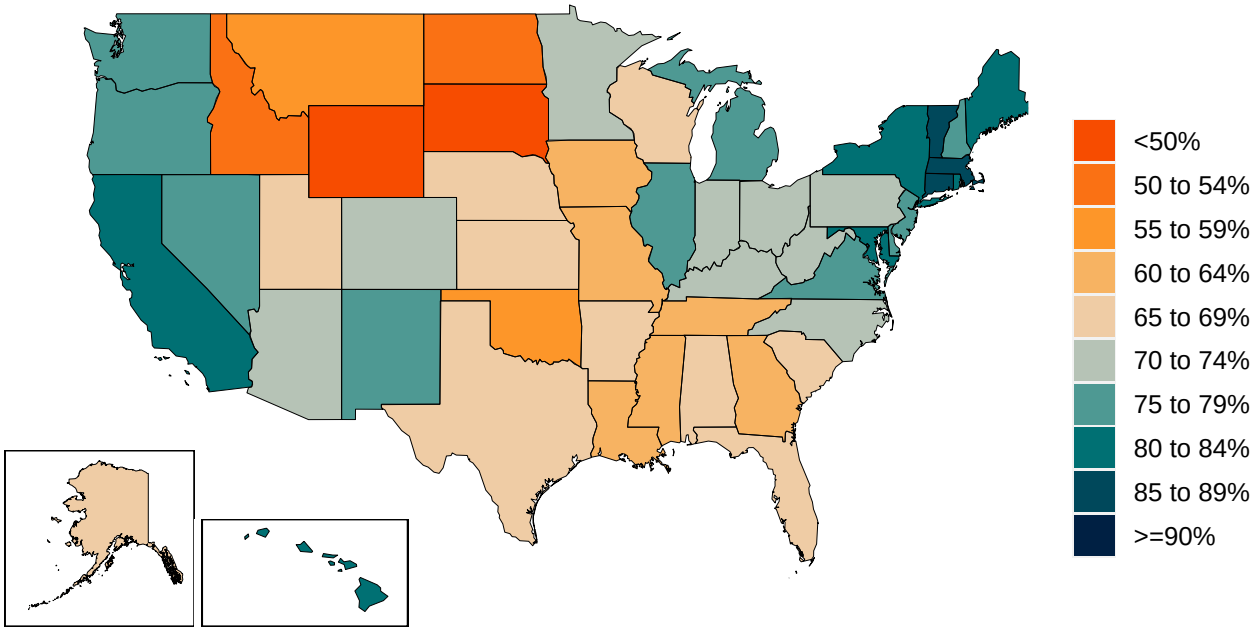


Figure 13. Trend in COVID-19 diagnostic tests per 100,000 people

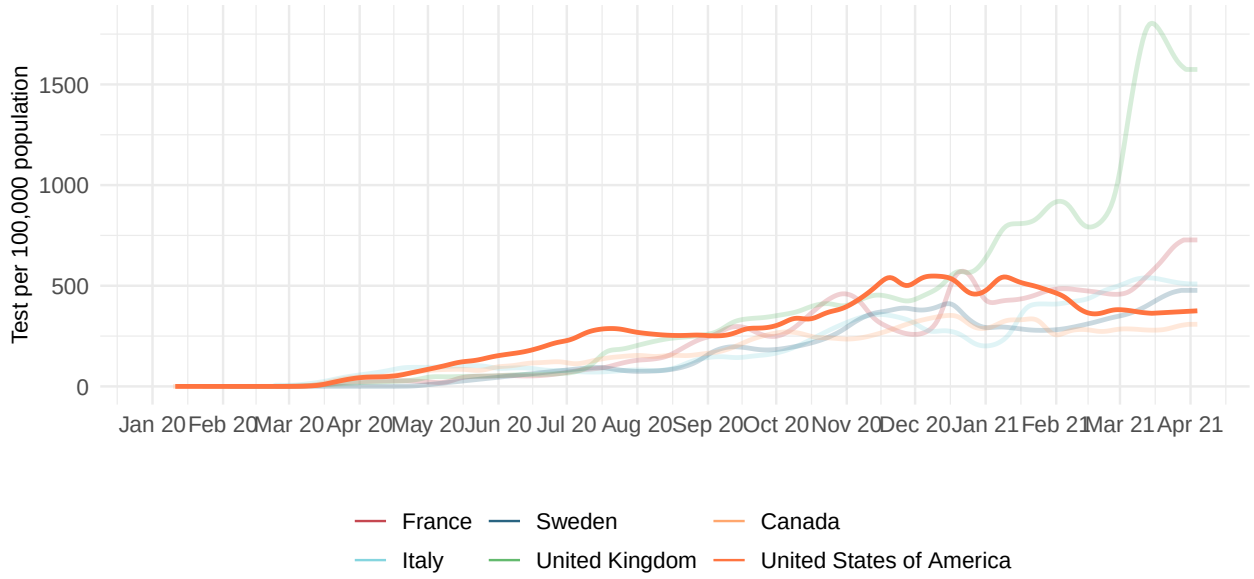


Figure 14. COVID-19 diagnostic tests per 100,000 people on March 15, 2021

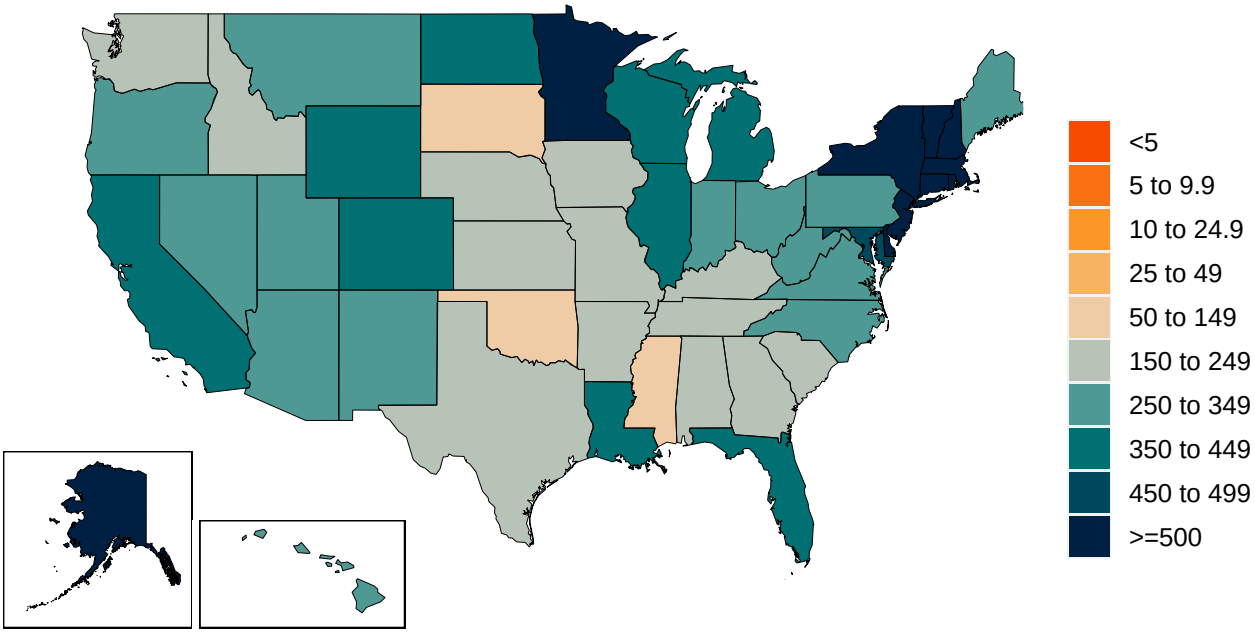


Figure 15. Increase in the risk of death due to pneumonia on February 1 2020 compared to August 1 2020

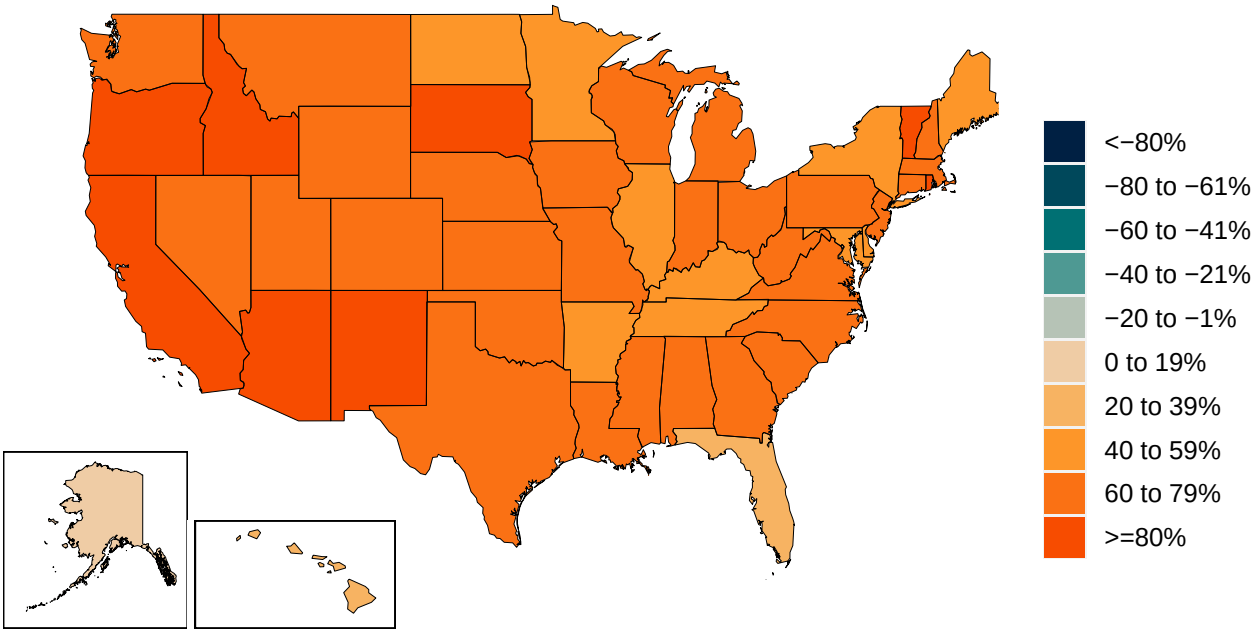


Table 3. The SEIR model uses variant-specific estimates of vaccine efficacy at preventing symptomatic disease and at preventing infection. We use data from clinical trials directly, where available, and make estimates otherwise. More information can be found on our website (http://www.healthdata.org/node/8584).

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%	7%
CanSinoBio	66%	57%	50%	44%
CoronaVac	50%	43%	38%	33%
Johnson & Johnson	72%	72%	64%	56%
Moderna	94%	85%	72%	62%
Novavax	89%	77%	49%	43%
Pfizer/BioNTech	91%	86%	69%	61%
Sinopharm	73%	63%	56%	48%
Sputnik V	92%	80%	70%	61%
Other mRNA vaccines	95%	83%	72%	63%
All other vaccines	75%	65%	57%	50%

Figure 16. Trend in 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).

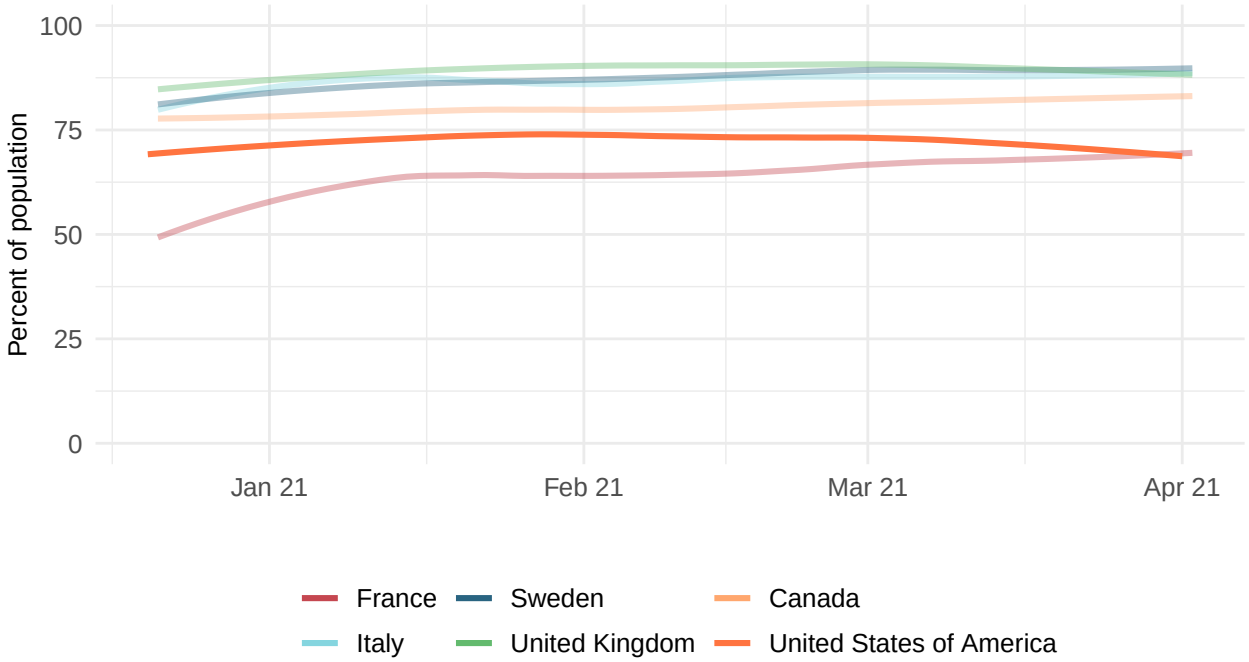


Figure 17. This figure shows the estimated proportion of the adult (18+) population that have been vaccinated or is open to receiving a COVID-19 vaccine based on Facebook survey responses (yes and yes, probably).

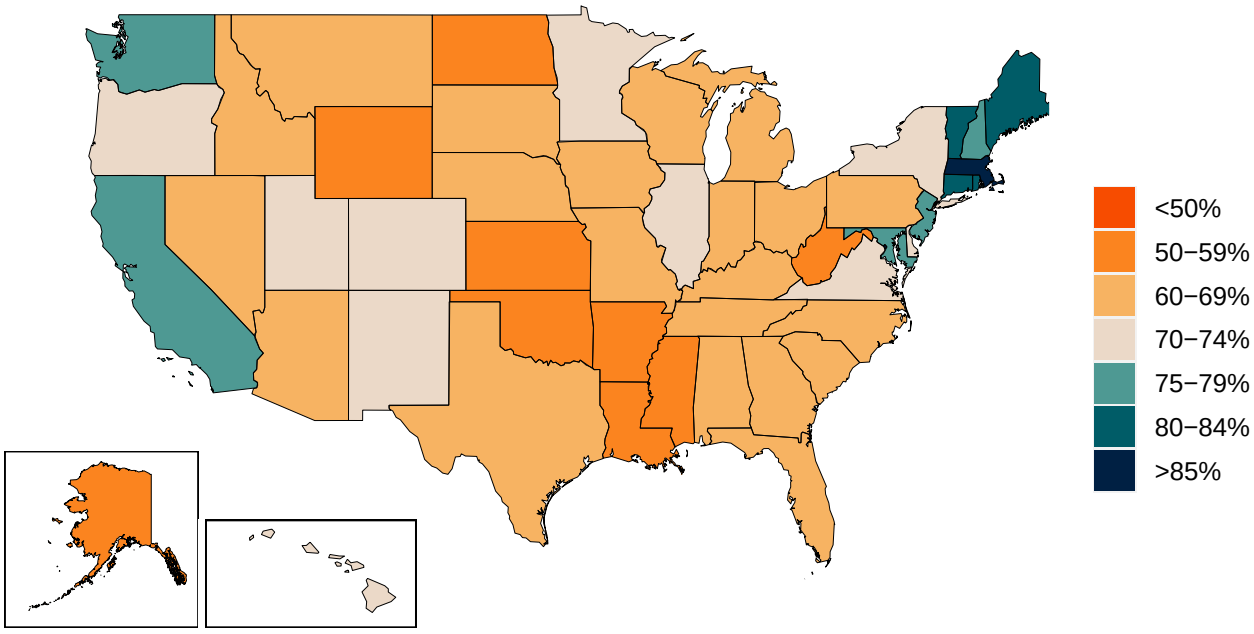
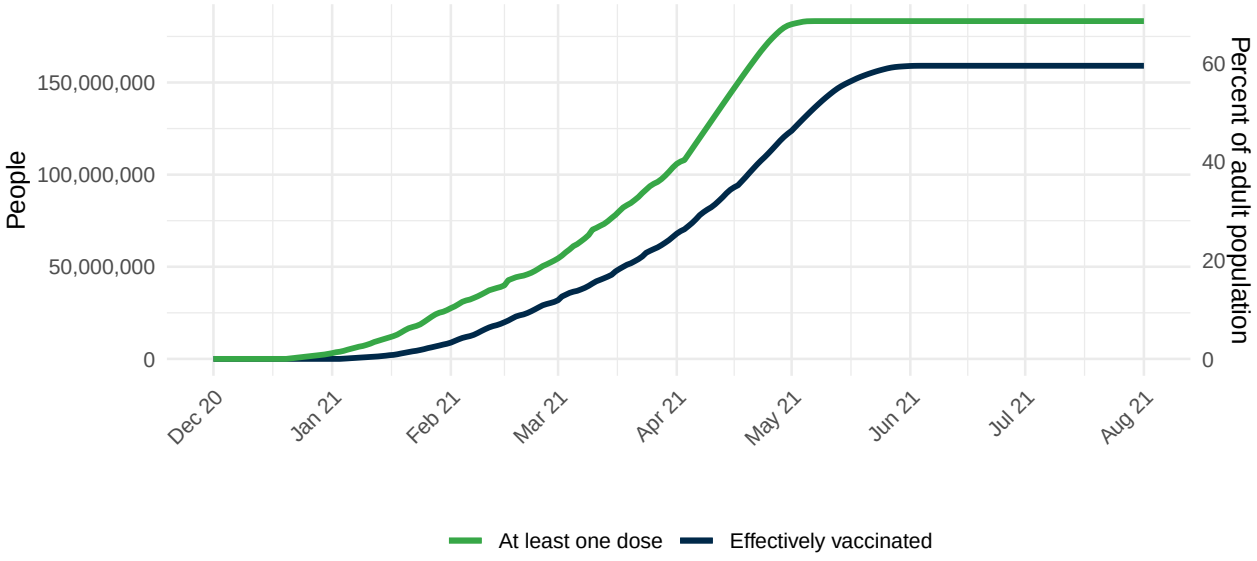


Figure 18. The number of people who receive any vaccine and those who are effectively vaccinated and protected against disease, accounting for efficacy, loss to follow up for two-dose vaccines, partial immunity after one dose, and immunity after two doses.



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

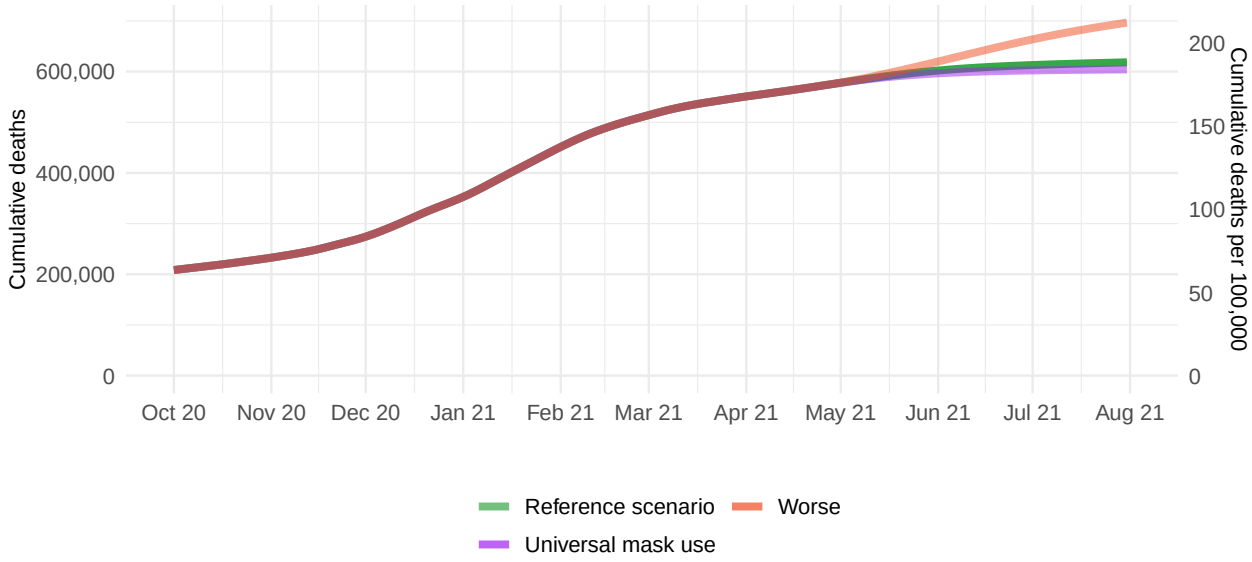


Figure 20. Daily COVID-19 deaths until August 01, 2021 for three scenarios,

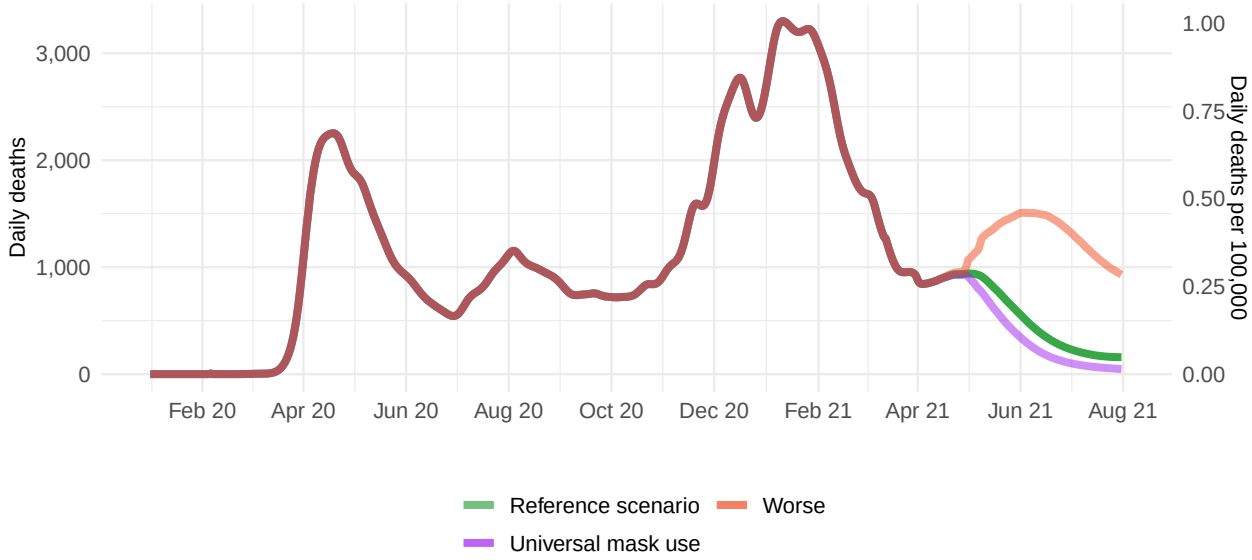


Figure 21. Daily COVID-19 infections until August 01, 2021 for three scenarios.

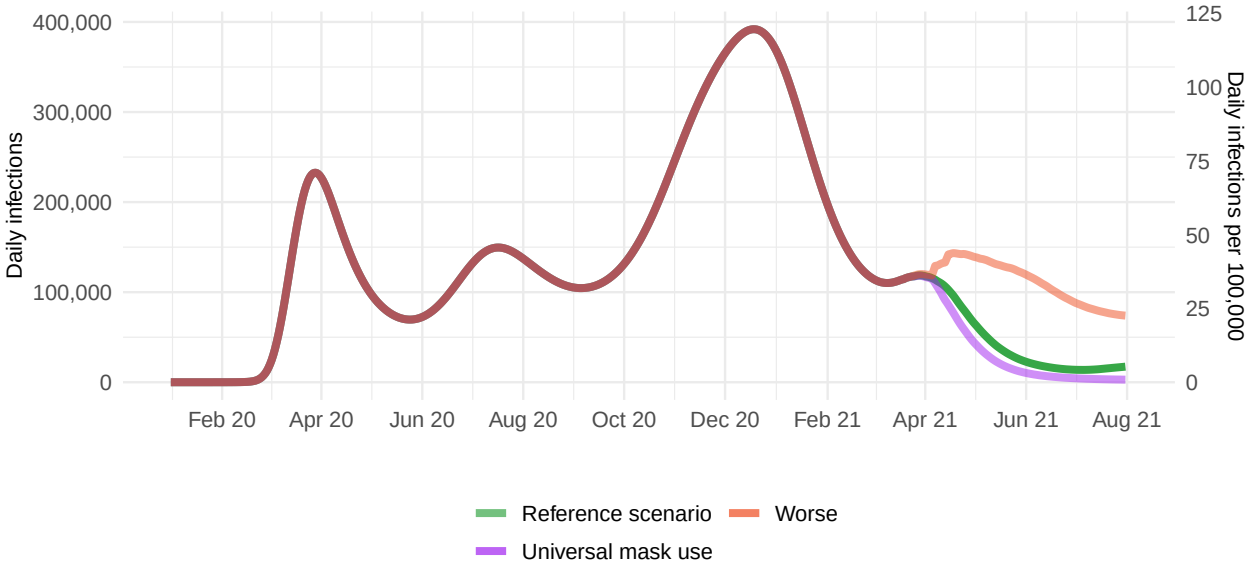


Figure 22. Comparison of reference model projections with other COVID modeling groups. For this comparison, we are including projections of daily COVID-19 deaths from other modeling groups when available: Delphi from the Massachussets Institute of Technology (Delphi; https://www.covidanalytics.io/home),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

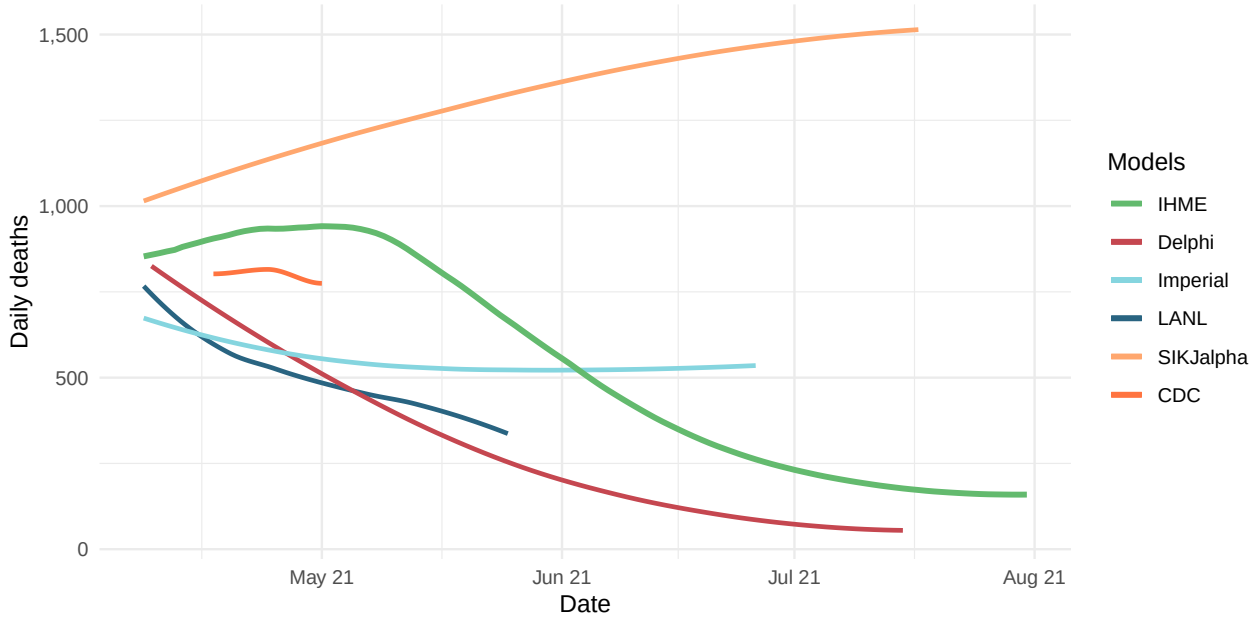


Figure 23. The estimated inpatient hospital usage is shown over time. The percent of hospital beds occupied by COVID-19 patients is color coded based on observed quantiles of the maximum proportion of beds occupied by COVID-19 patients. Less than 5% is considered *low stress*, 5-9% is considered *moderate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

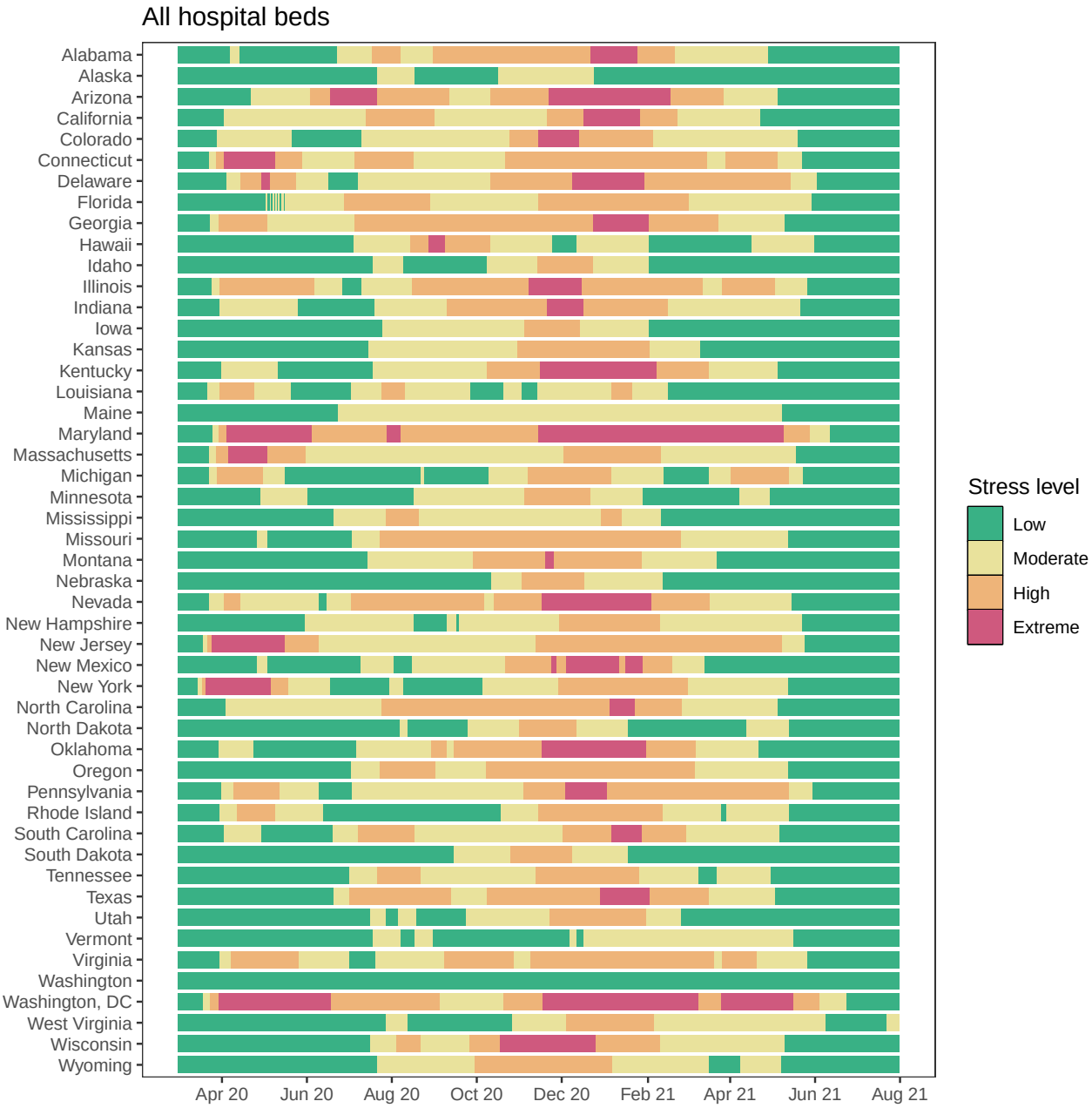
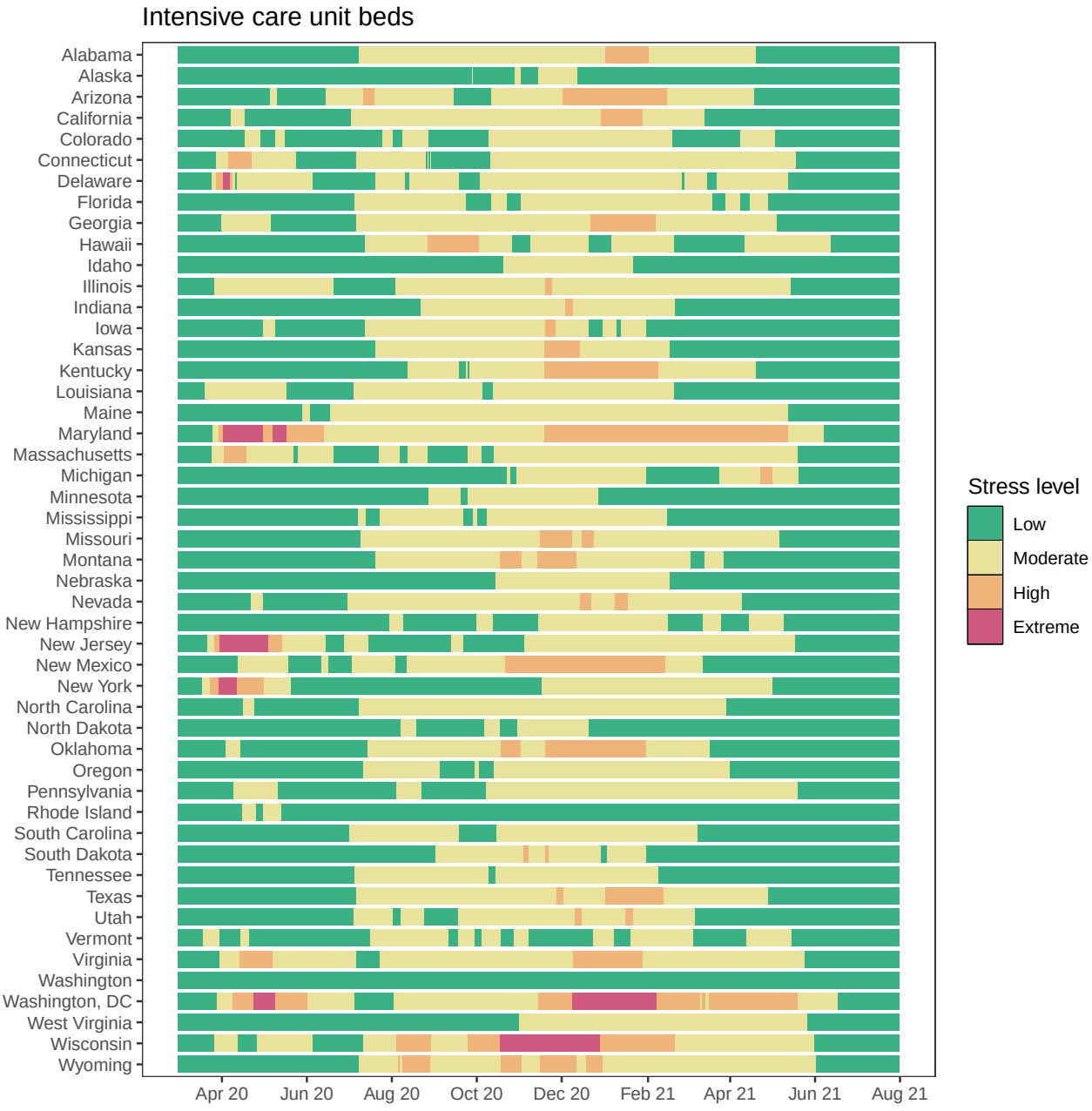


Figure 24. The estimated intensive care unit (ICU) usage is shown over time. The percent of ICU beds occupied by COVID-19 patients is color coded based on observed quantiles of the maximum proportion of ICU beds occupied by COVID-19 patients. Less than 10% is considered *low stress*, 10-29% is considered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