

COVID-19 Results Briefing

Indiana

March 24, 2021

This document contains summary information on the latest projections from the IHME model on COVID-19 in Indiana. The model was run on March 23, 2021 with data through March 22, 2021.

Current situation

- Daily reported cases in the last week decreased to 750 per day on average compared to 820 the week before (Figure 1).
- Daily deaths in the last week decreased to 12 per day on average compared to 17 the week before (Figure 2). This makes COVID-19 the number 4 cause of death in Indiana this week (Table 1).
- The daily death rate is greater than 4 per million in Alabama, Kentucky, Massachusetts, New Jersey, Ohio, Texas, and West Virginia (Figure 3).
- We estimated that 16% of people in Indiana have been infected as of March 22 (Figure 4).
- Effective R, computed using cases, hospitalizations, and deaths, is greater than 1 in 23 states (Figure 5). The Effective R in Indiana on March 11 was 1.01.

Trends in drivers of transmission

- Mobility last week was 8% lower than the pre-COVID-19 baseline (Figure 9). Mobility was near baseline (within 10%) in 22 states. Mobility was lower than 30% of baseline in California, and the District of Columbia.
- As of March 22 we estimated that 72% of people always wore a mask when leaving their home compared to 72% last week (Figure 11). Mask use was lower than 50% in Wyoming.
- There were 325 diagnostic tests per 100,000 people on March 22 (Figure 13).
- In Indiana 69.1% 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 53% in Wyoming to 87% in District Of Columbia (Figure 16).
- In our current reference scenario, we expect that 3.76 million will be vaccinated by July 1 (Figure 17).

Projections

- If **universal mask coverage (95%)** were attained in the next week, our model projects 180 fewer cumulative deaths compared to the reference scenario on July 1, 2021 (Figure 18).
- Under our **worse scenario**, our model projects 15,000 cumulative deaths on July 1, 2021 (Figure 18).
- In our **reference scenario**, which represents what we think is most likely to happen, our model projects 14,000 cumulative deaths on July 1, 2021. This represents 860 additional deaths from March 22 to July 1 (Figure 18). Daily deaths are expected to decline steadily until July 1 (Figure 19).
- By July 1, we project that 1,200 lives will be saved by the projected vaccine rollout.
- Figure 21 compares our reference scenario forecasts to other publicly archived models. Forecasts are widely divergent.
- At some point from March through July 1, 18 states will have high or extreme stress on hospital beds (Figure 22). At some point from March through July 1, 2 states will have high or extreme stress on ICU capacity (Figure 23).

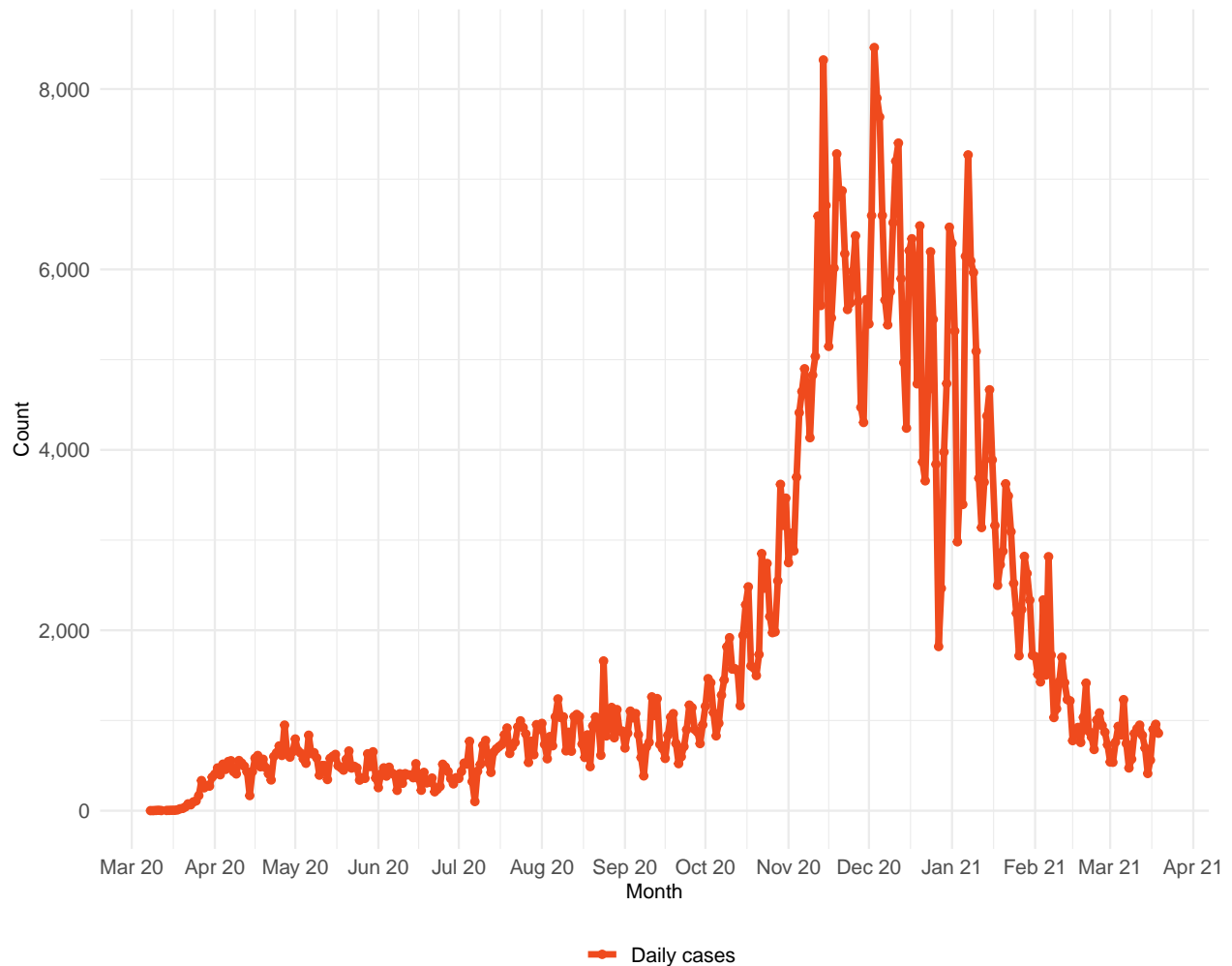
Model updates

Up until this week, we have been using a model that allowed variants of concern to spread in a local fashion, i.e., to neighboring locations. This week, we have updated our model for the variants of concern (VOC) to include two types of spread: 1) local spread to nearest neighboring locations, like previously, and 2) long-distance spread based on distance between locations and the relative population sizes of locations.

For the first type of spread, we continue to use spread speeds based on observed patterns of B.1.1.7 invasion into the United Kingdom. For the second type of spread, which is introduced for the first time this week, where the variants of concern spread across non-adjacent locations, we use a gravity model that is based on matching patterns of B.1.1.7 dispersal globally. These types of models have been used in other endemic (e.g., influenza, measles) and pandemic (e.g., SARS, Ebola, Zika, yellow fever) settings and have been demonstrated to predict the spread of infectious diseases across various spatial scales.

Gravity models assume that the variant spread between two locations depends both on the physical distance between the locations and the population size of each location. Gravity models allow larger populations that are closer to each other to have more interaction than smaller populations. To parameterize the gravity model for the spread of the variants of concern, we calculate the relative flows of B.1.1.7 out of the United Kingdom to other locations, using a survival model and data on local transmission dates from GISAID. Given sparse data from GISAID and the fact that the majority of locations globally have not been identified to have local B.1.1.7 transmission, the accuracy of the survival model for low flow rate locations is highly uncertain and will continue to improve as more data become available. To accommodate this, we chose a “minimum flow rate threshold” and only used flow rates greater than this threshold to predict timing of future invasions for other locations.

Finally, starting with the observed timing of onset of local transmission by variant for those locations that have already experienced local transmission of a VOC, we use both the local and long-distance spread models to estimate the timing of movement of the variants. By stepping through each day in the future, we then estimate the ongoing spread by repeating the local and long-distance spread of each location based on when it is predicted to begin experiencing local VOC transmission.

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 | 238 | 1 |
| Chronic obstructive pulmonary disease | 100 | 2 |
| Tracheal, bronchus, and lung cancer | 100 | 3 |
| COVID-19 | 85 | 4 |
| Stroke | 83 | 5 |
| Alzheimer's disease and other dementias | 61 | 6 |
| Chronic kidney disease | 53 | 7 |
| Diabetes mellitus | 36 | 8 |
| Colon and rectum cancer | 36 | 9 |
| Drug use disorders | 32 | 10 |

Figure 2. Reported daily COVID-19 deaths

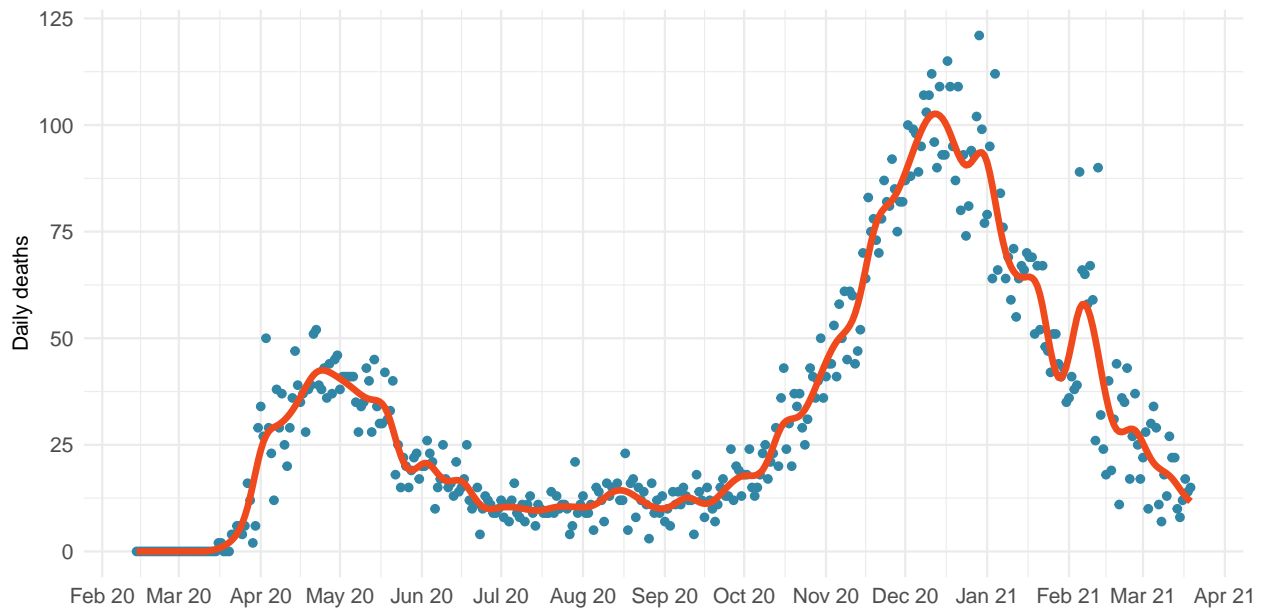


Figure 3. Daily COVID-19 death rate per 1 million on March 22, 2021

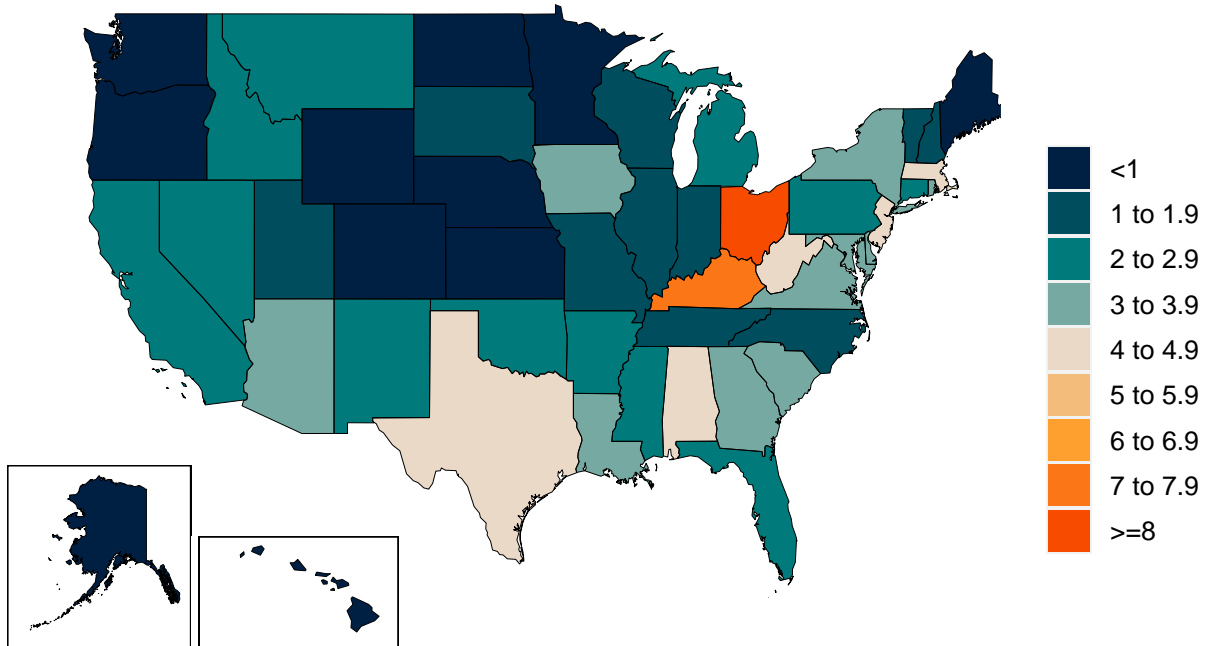


Figure 4. Estimated percent of the population infected with COVID-19 on March 22, 2021

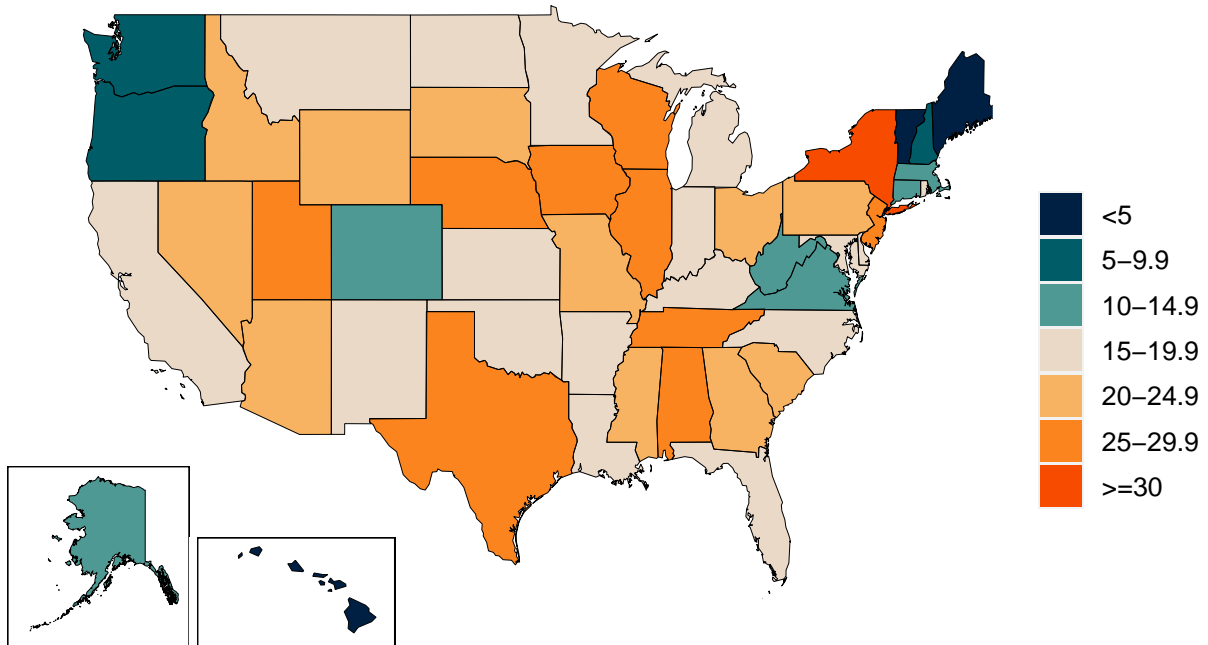


Figure 5. Mean effective R on March 11, 2021. The estimate of effective R is based on the combined analysis of deaths, case reporting, and hospitalizations where available. Current reported cases reflect infections 11-13 days prior, so estimates of effective R can only be made for the recent past. Effective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

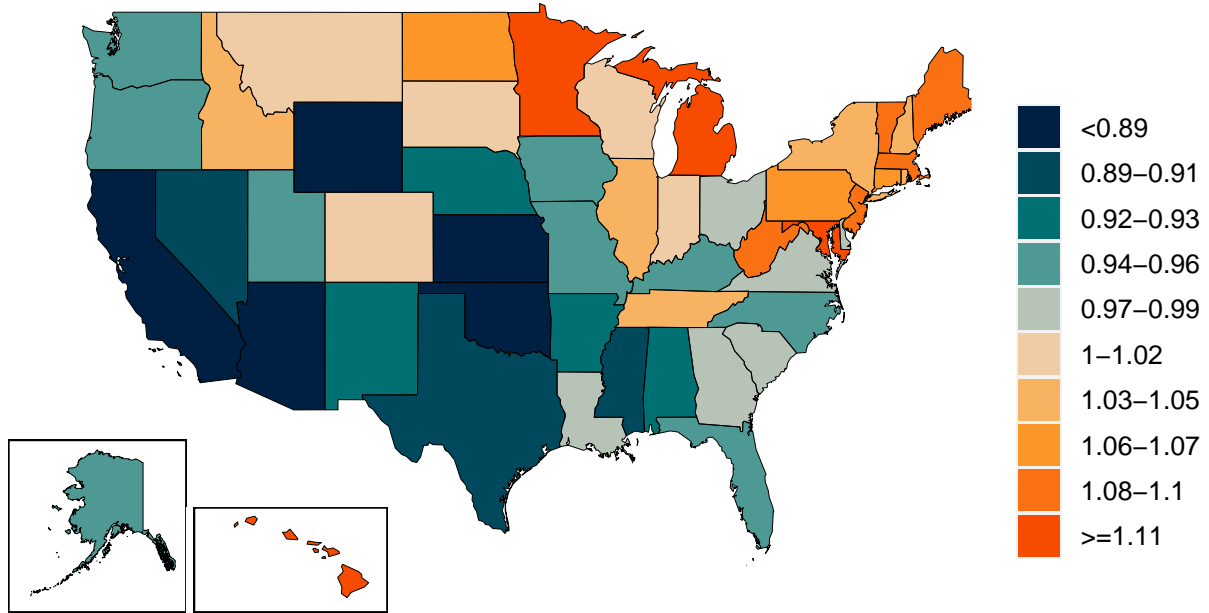
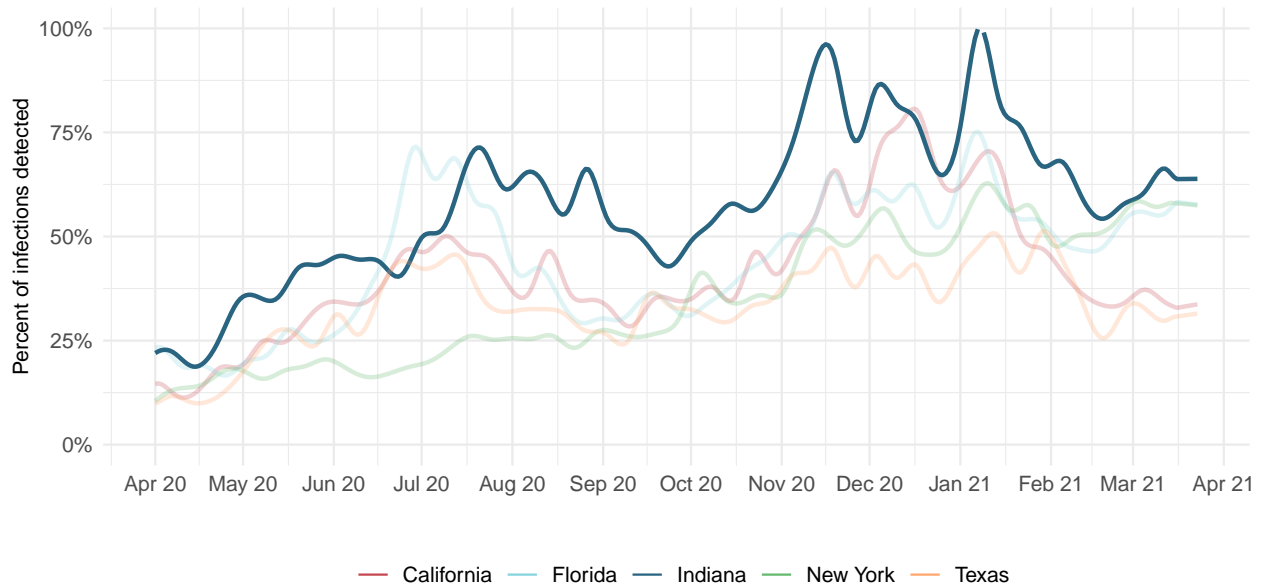


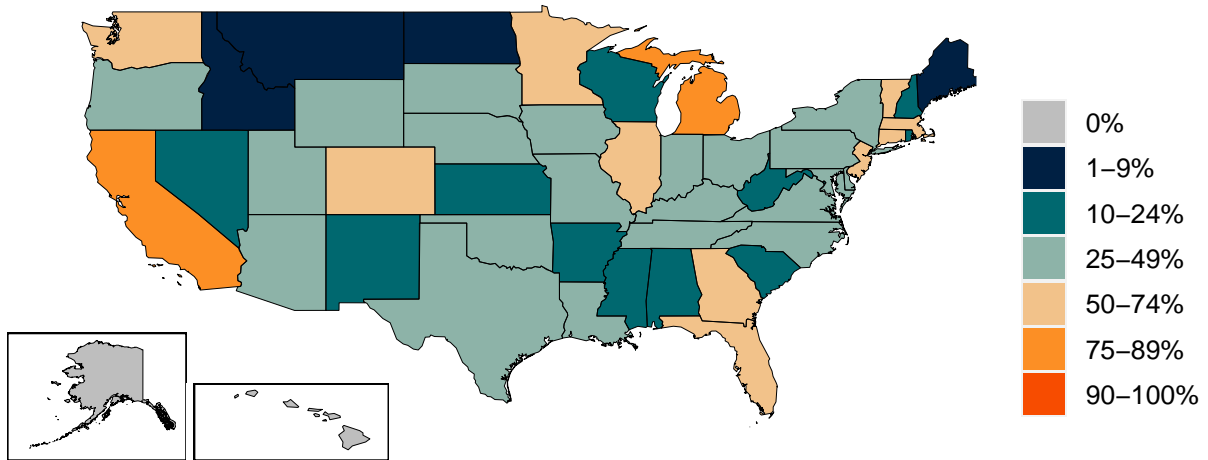
Figure 6. Percent of COVID-19 infections detected. This is estimated as the ratio of reported daily COVID-19 cases to estimated daily COVID-19 infections based on the SEIR disease transmission model.



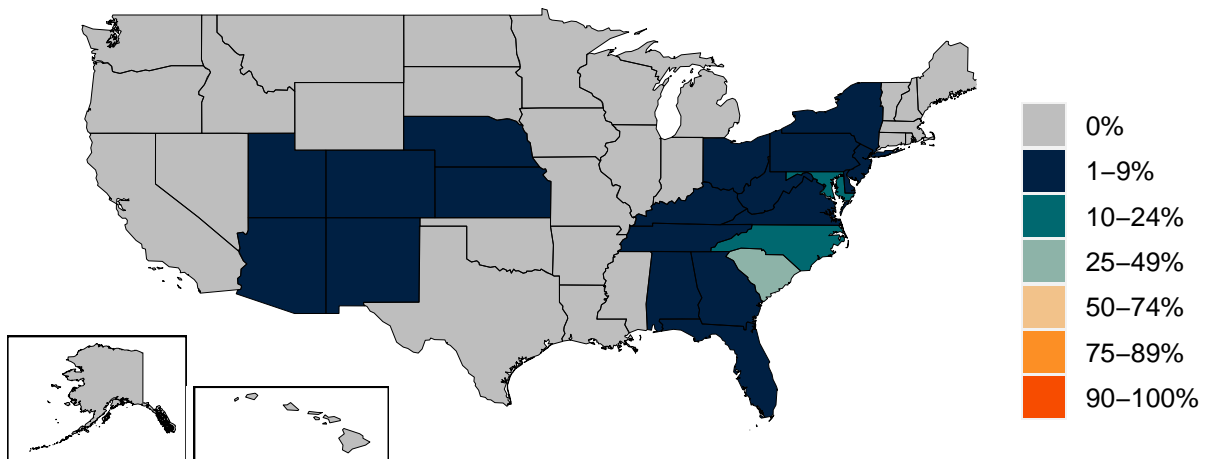
*Due to measurement errors in cases and testing rates, the infection to detection rate (IDR) can exceed 100% at particular points in time.

Figure 7. Percent of circulating SARS-CoV-2 for 3 primary variants on March 22, 2021.

A. Percent B.1.1.7 variant



B. Percent B.1.351 variant



C. Percent P1 variant

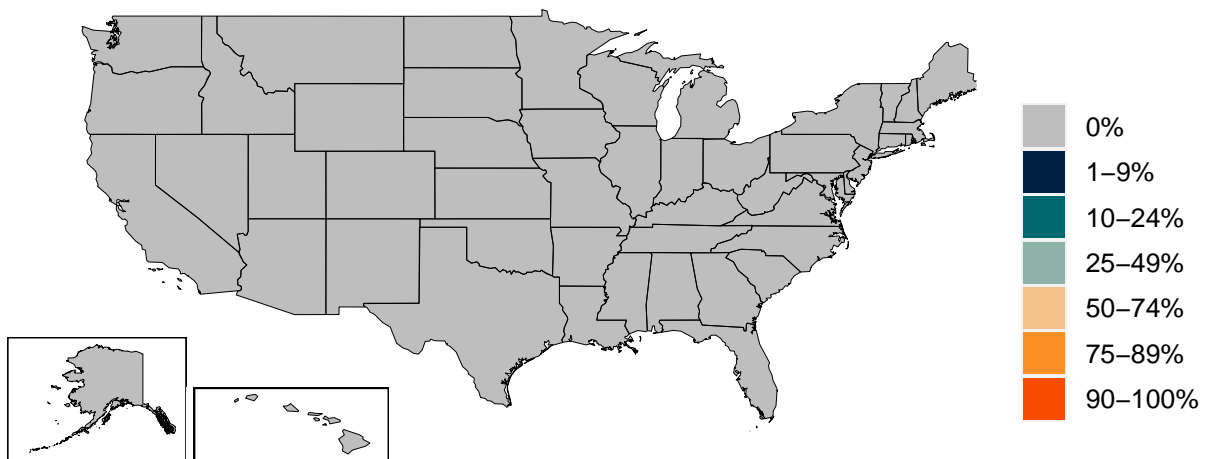
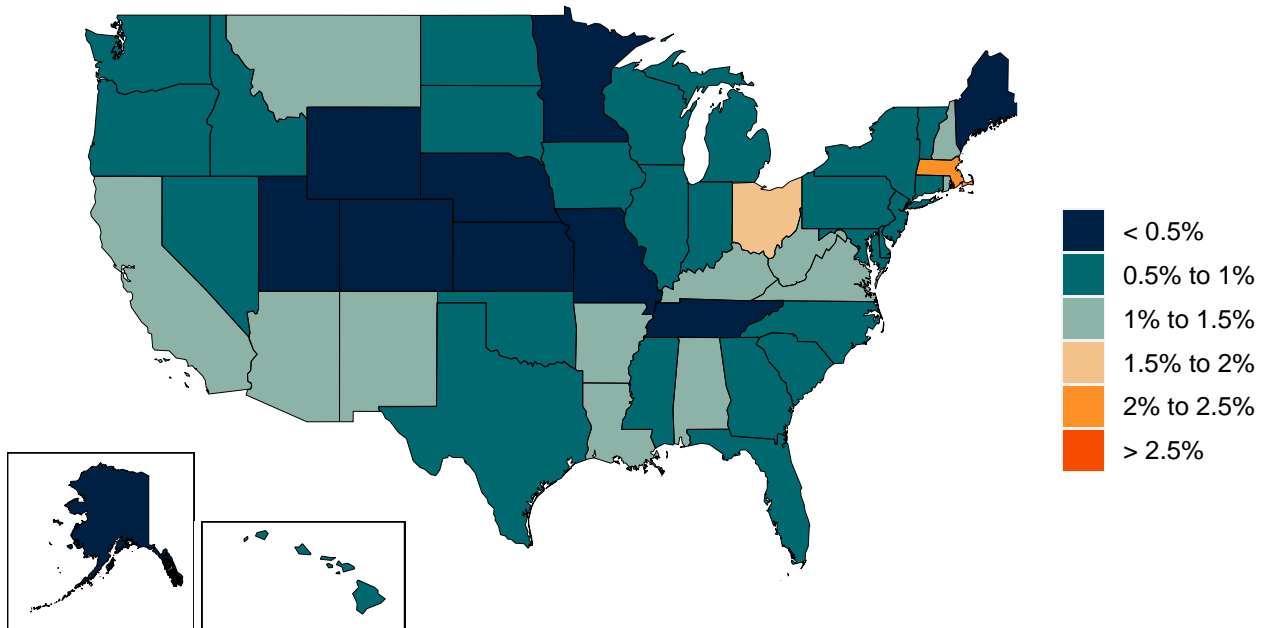


Figure 8. Infection fatality ratio on March 22, 2021. This is estimated as the ratio of COVID-19 deaths to infections based on the SEIR disease transmission model.



Critical drivers

Table 2. Current mandate implementation



*Not all locations are measured at the subnational level.

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

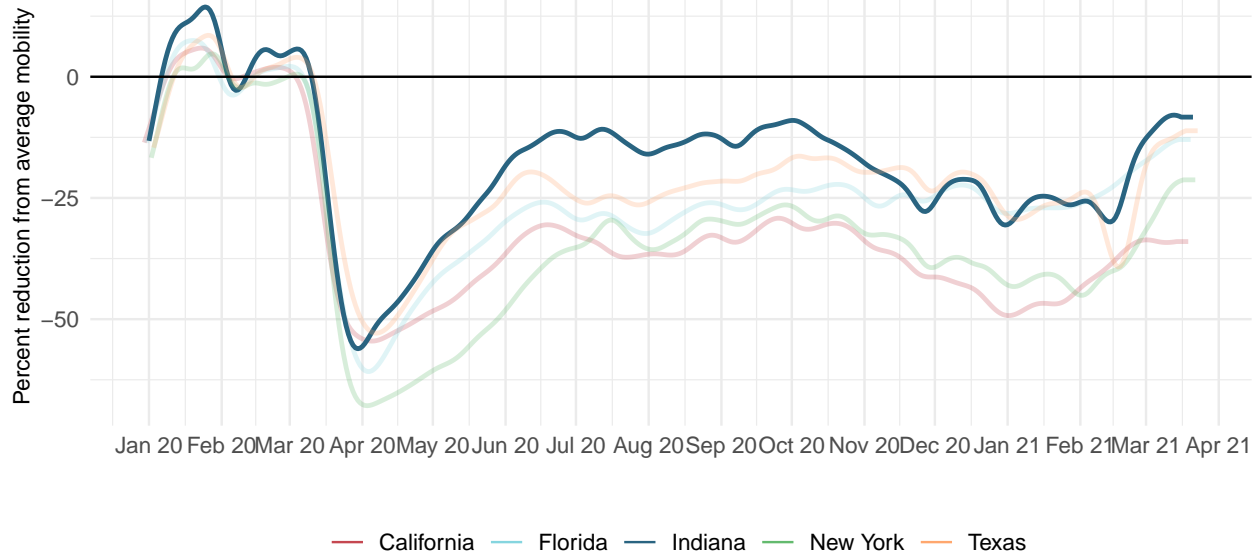


Figure 10. Mobility level as measured through smartphone app use compared to January 2020 baseline (percent) on March 22, 2021

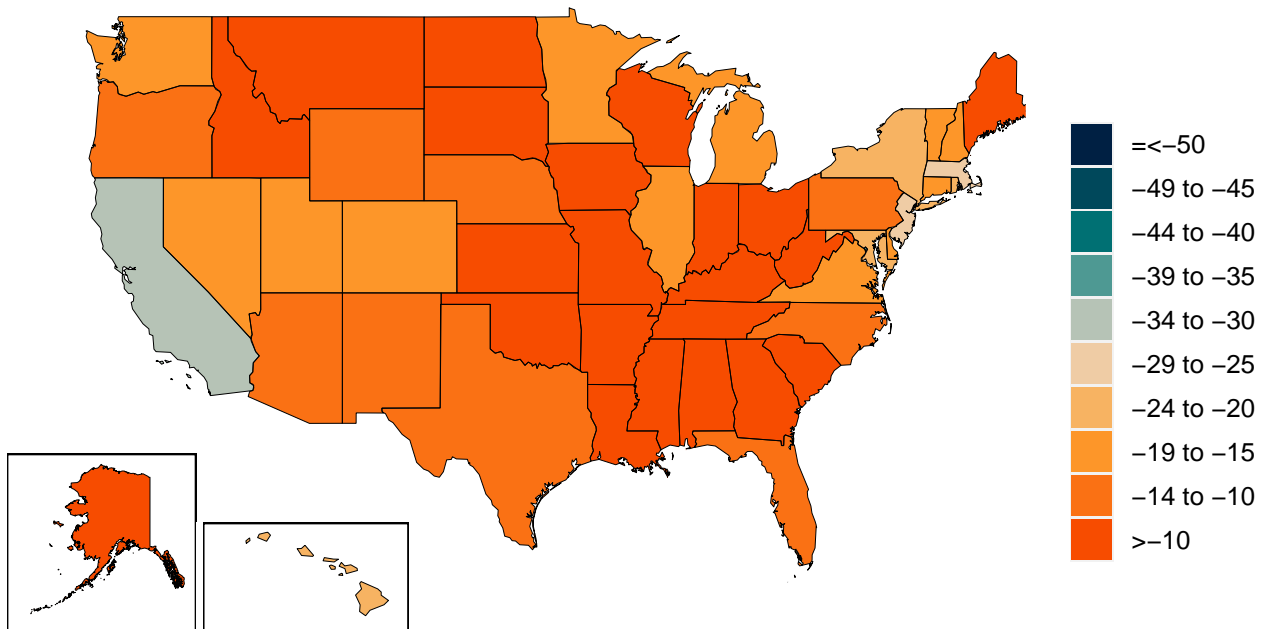


Figure 11. Trend in the proportion of the population reporting always wearing a mask when leaving home

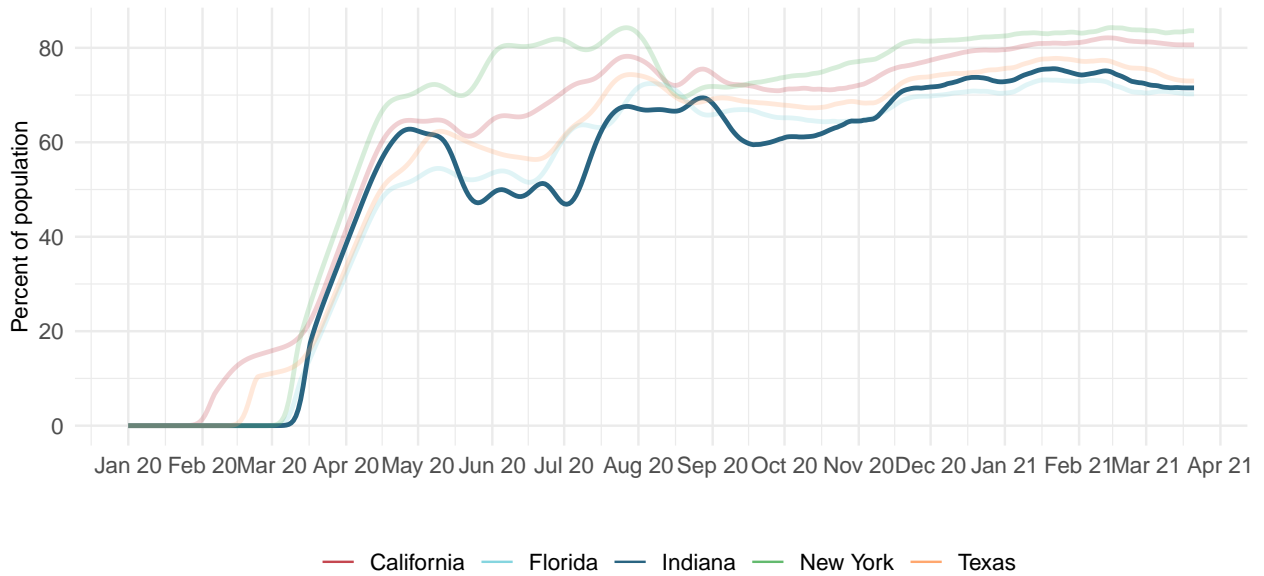


Figure 12. Proportion of the population reporting always wearing a mask when leaving home on March 22, 2021

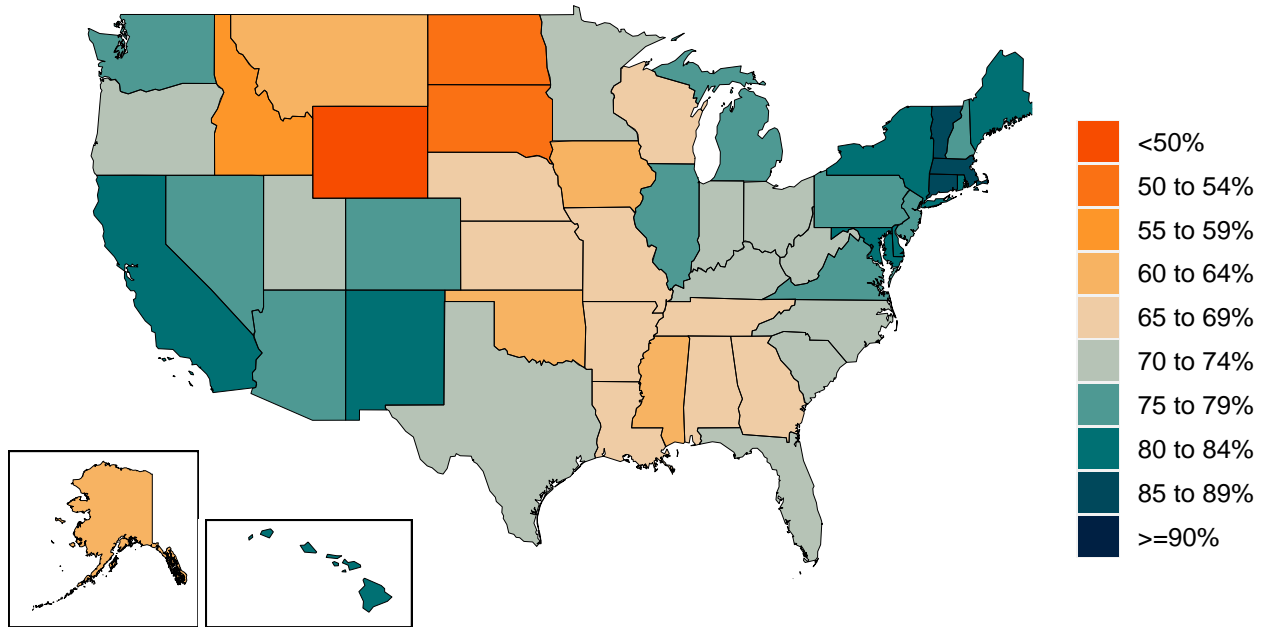


Figure 13. Trend in COVID-19 diagnostic tests per 100,000 people

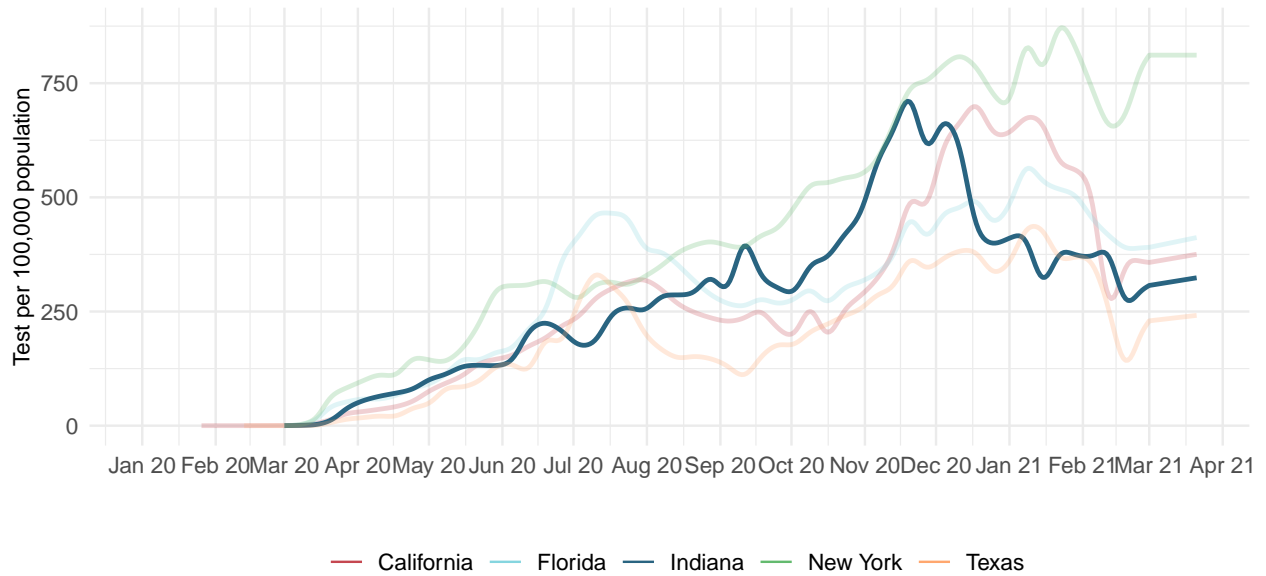


Figure 14. COVID-19 diagnostic tests per 100,000 people on March 01, 2021

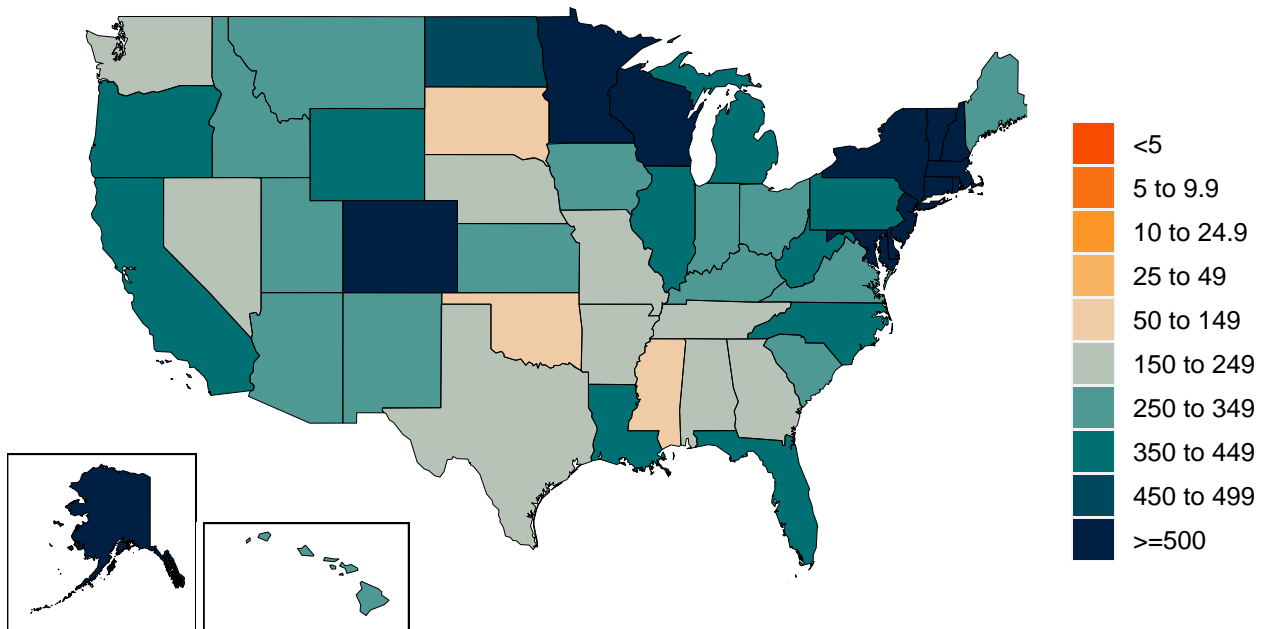


Figure 15. Increase in the risk of death due to pneumonia on February 1 2020 compared to August 1 2020

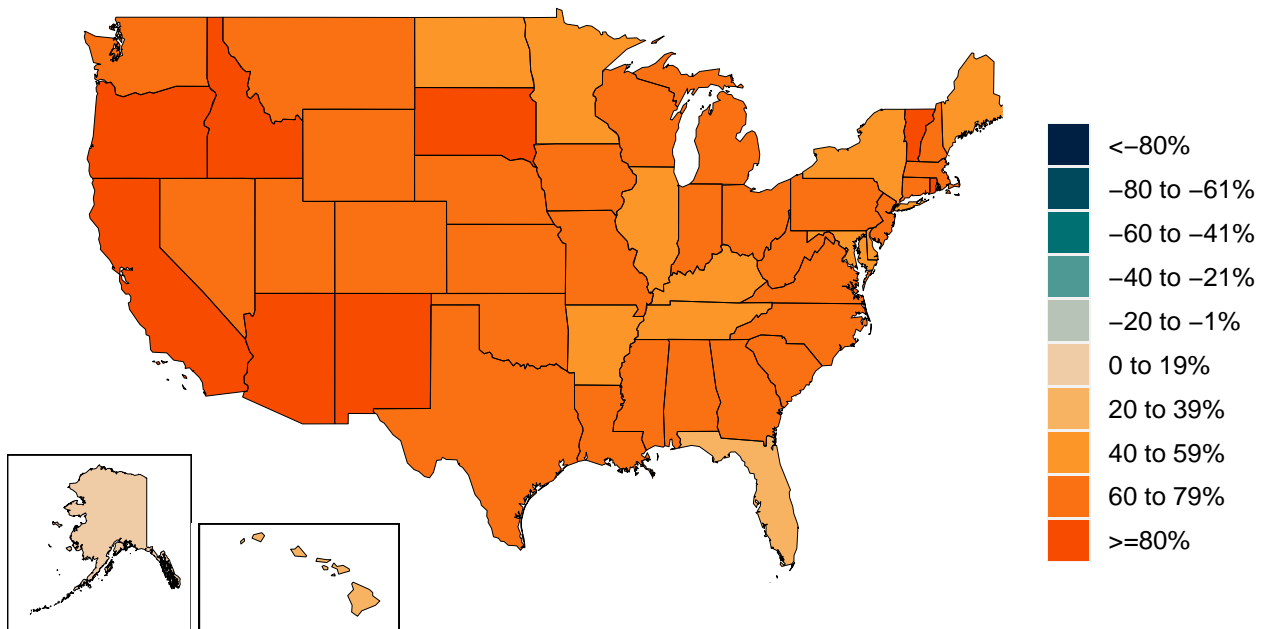


Table 3. The SEIR model uses variant-specific estimates of vaccine efficacy at preventing symptomatic disease and at preventing infection. We use data from clinical trials directly, where available, and make estimates otherwise. More information can be found on our website (<http://www.healthdata.org/node/8584>).

| 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 | 74% | 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 | 95% | 86% | 72% | 63% |
| 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. This figure shows the estimated proportion of the adult (18+) population that is open to receiving a COVID-19 vaccine based on Facebook survey responses (yes and yes, probably).

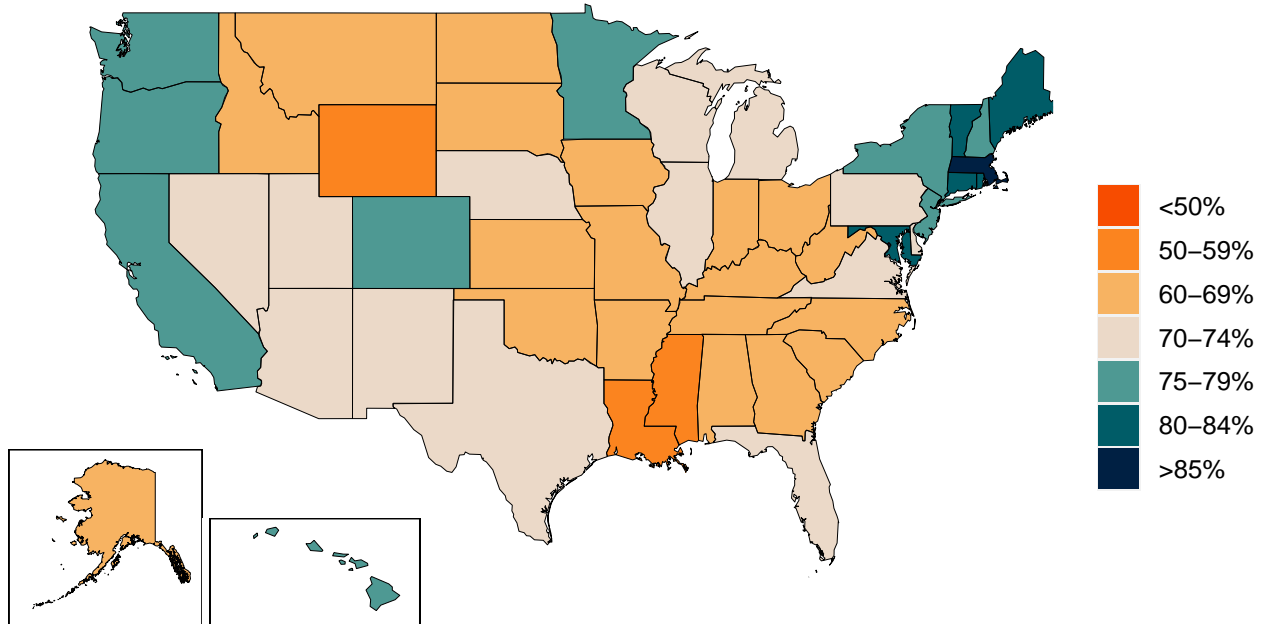
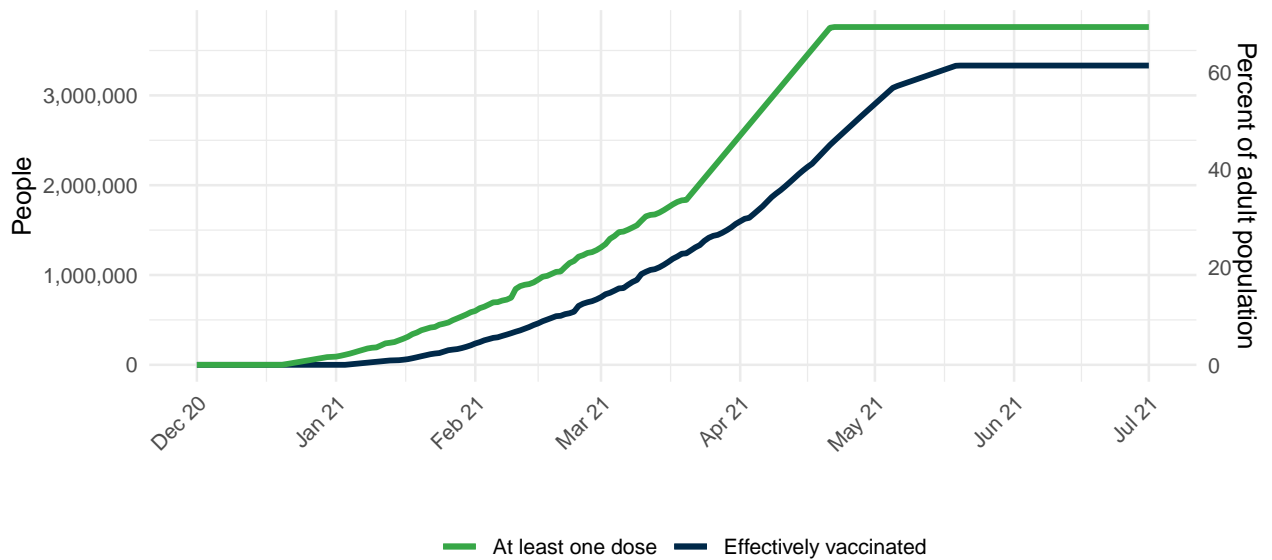


Figure 17. The number of people who receive any vaccine and those who are effectively vaccinated and protected against disease, accounting for efficacy, loss to follow up for two-dose vaccines, partial immunity after one dose, and immunity after two doses.



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

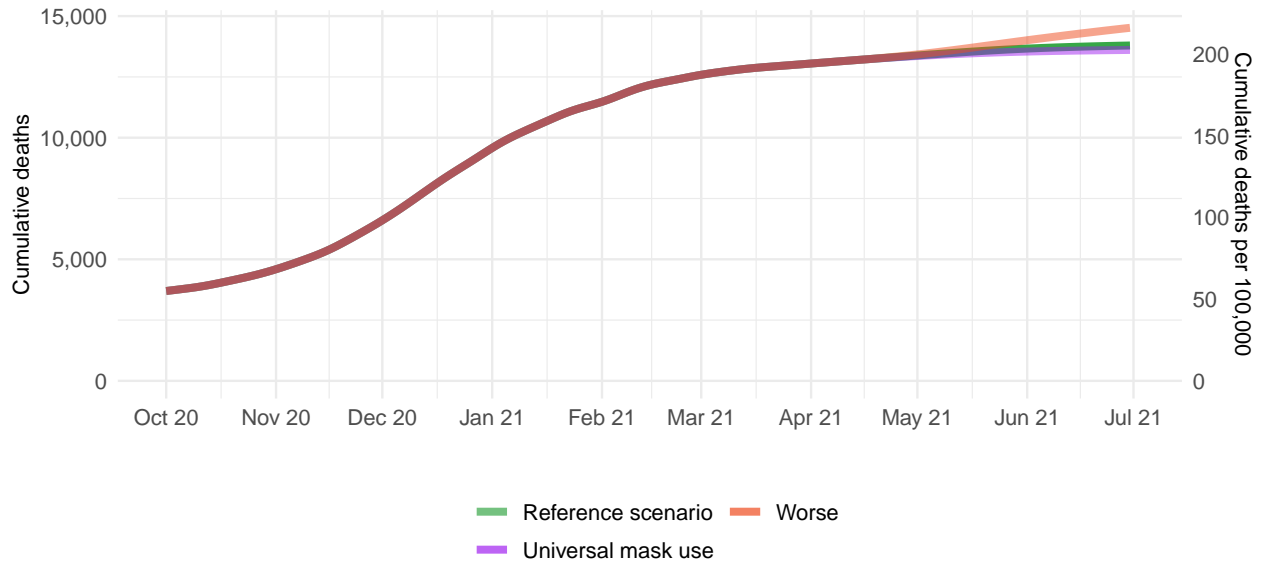


Figure 19. Daily COVID-19 deaths until July 01, 2021 for three scenarios

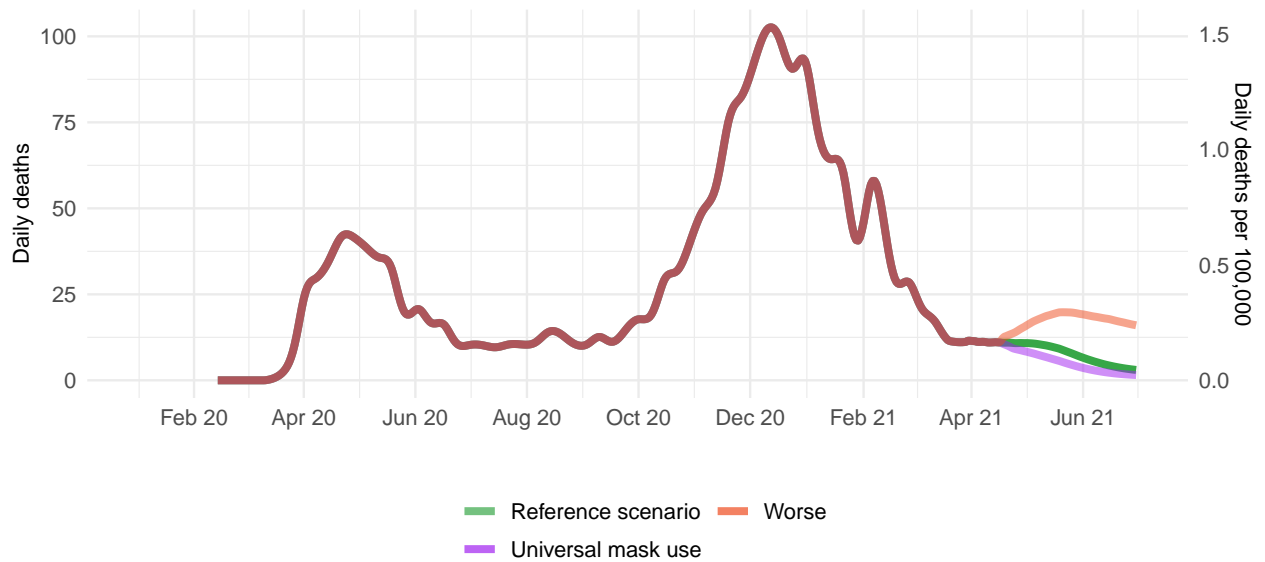


Figure 20. Daily COVID-19 infections until July 01, 2021 for three scenarios

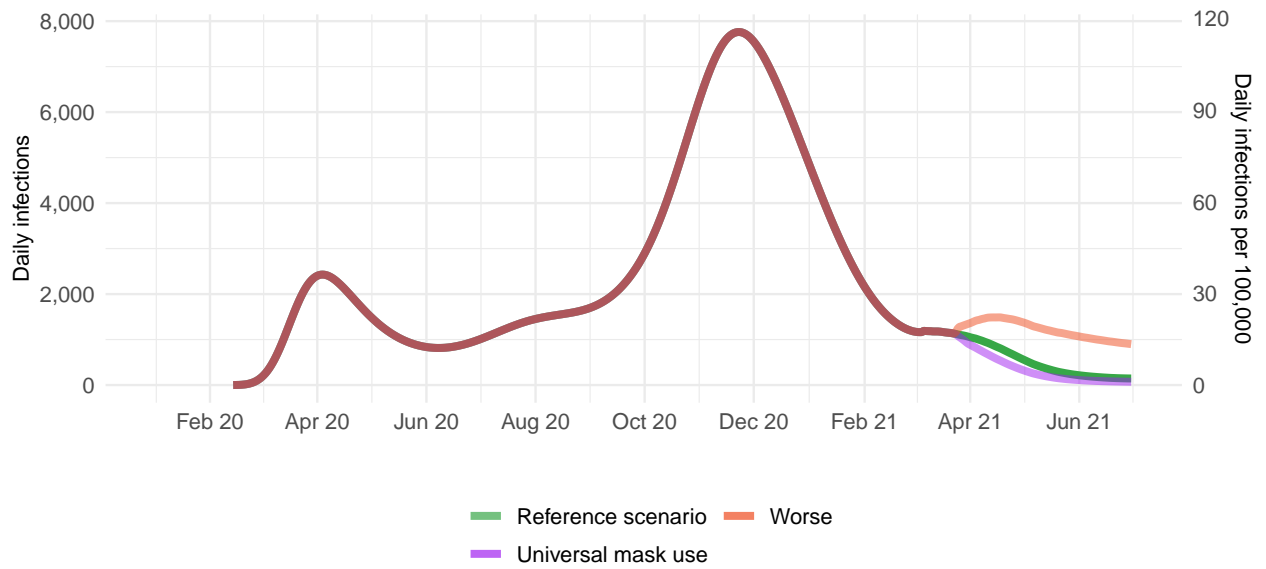


Figure 21. Comparison of reference model projections with other COVID modeling groups. For this comparison, we are including projections of daily COVID-19 deaths from other modeling groups when available: Delphi from the Massachusetts Institute of Technology (Delphi; <https://www.covidanalytics.io/home>), Imperial College London (Imperial; <https://www.covidsim.org>), The Los Alamos National Laboratory (LANL; <https://covid-19.bsvgateway.org/>), and the SI-KJalpha model from the University of Southern California (SIKJalpha; <https://github.com/scc-usc/ReCOVER-COVID-19>). Daily deaths from other modeling groups are smoothed to remove inconsistencies with rounding. Regional values are aggregates from available locations in that region.

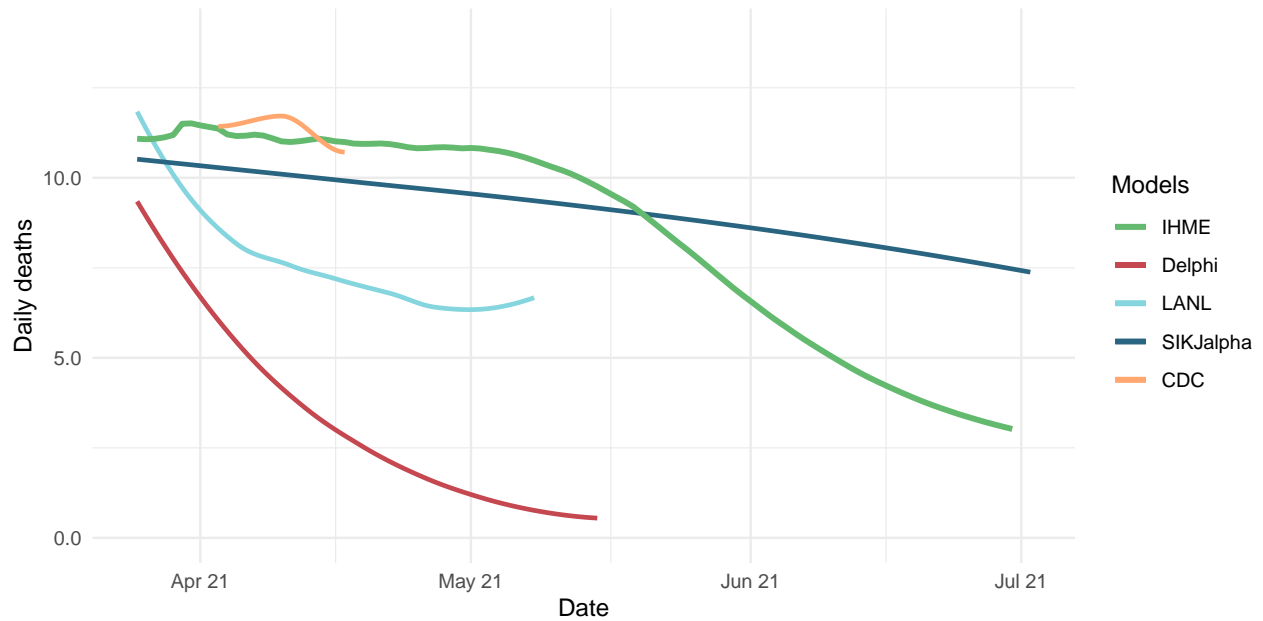


Figure 22. The estimated inpatient hospital usage is shown over time. The percent of hospital beds occupied by COVID-19 patients is color coded based on observed quantiles of the maximum proportion of beds occupied by COVID-19 patients. Less than 5% is considered *low stress*, 5-9% is considered *moderate stress*, 10-19% is considered *high stress*, and greater than 20% is considered *extreme stress*.

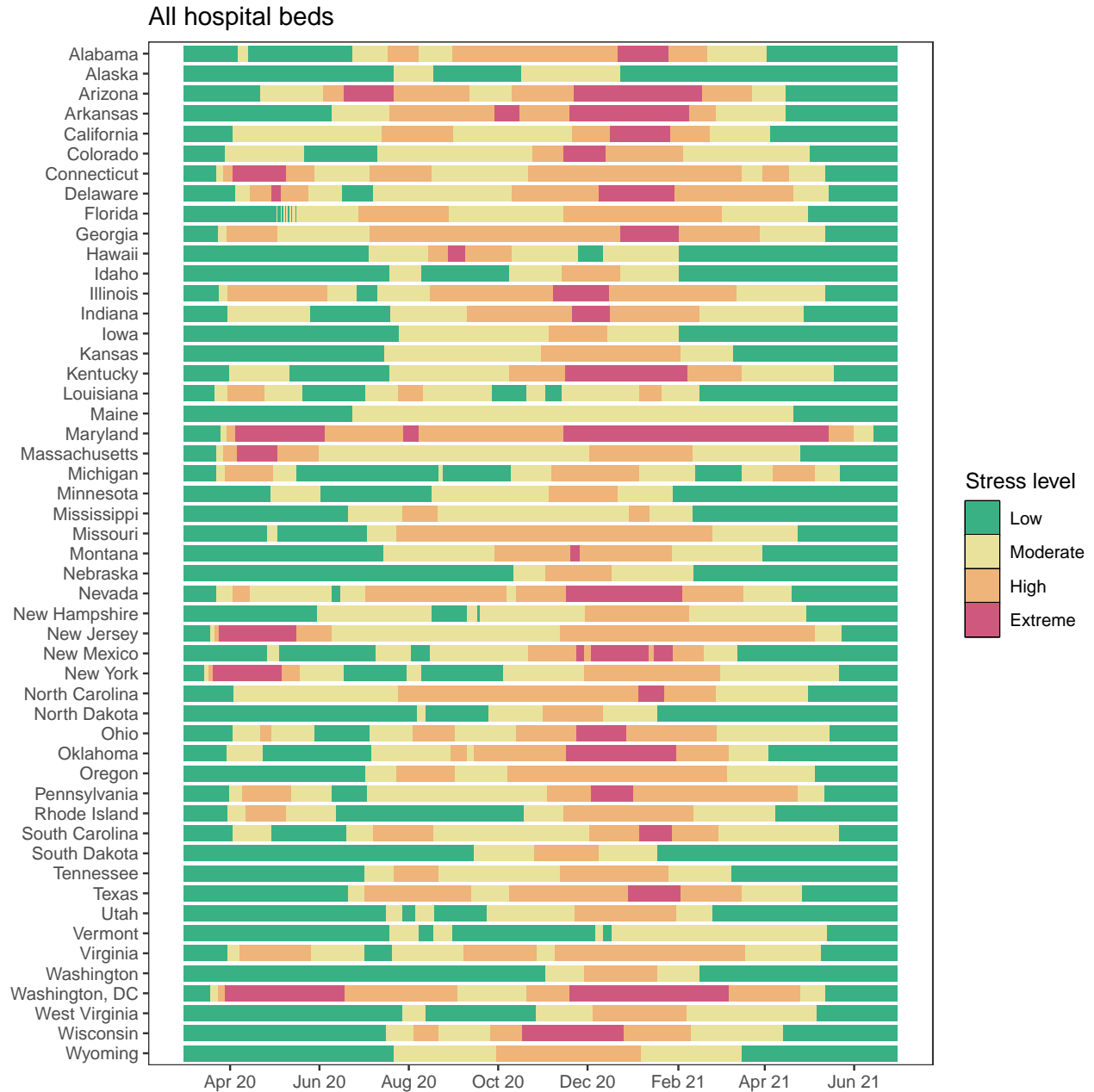
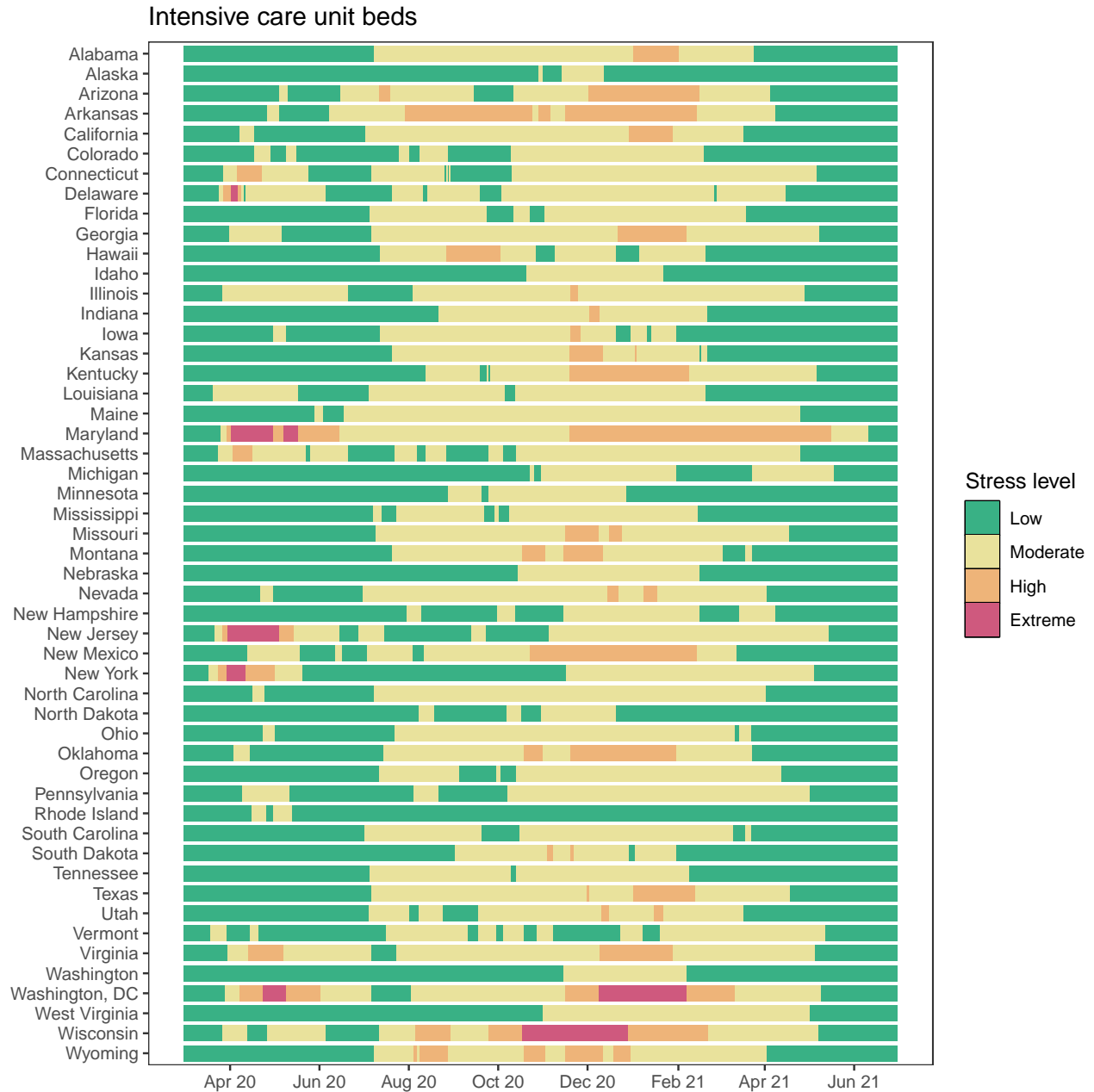


Figure 23. The estimated intensive care unit (ICU) usage is shown over time. The percent of ICU beds occupied by COVID-19 patients is color coded based on observed quantiles of the maximum proportion of ICU beds occupied by COVID-19 patients. Less than 10% is considered *low stress*, 10-29% is considered *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. GISAID data is subject to GISAID's [Terms and Conditions](#). Individuals and their contributing laboratories are outlined in full at [CoV-Lineages](#).

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>.