COVID-19 Results Briefing: United States of America

December 10, 2020

This document contains summary information on the latest projections from the IHME model on COVID-19 in United States of America. The model was run on December 8, 2020.

The epidemic in the US appears to have leveled off in many Midwestern states while continuing to increase on the West Coast and in parts of the Northeast. The leveling off in the Midwest is apparent in hospitalization data and case notifications but could be related to continuing data challenges after the Thanksgiving holiday. Alternatively, reduced mobility and more careful behaviors, along with selected mandates, may have been enough to bring effective R under 1. In this week's update, the impact of vaccination is greater as well because of the detailed information in the Pfizer FDA filing, which shows approximately 50% protection after the first dose, and data on a larger number of doses available sooner in the US. These trends combined mean our forecast for cumulative deaths by April 1 have been reduced to 502,000 cumulative deaths. We still expect daily deaths to peak in mid-January. 48 states are expected to have high or extreme stress on ICUs at some point in the next four months. Increasing mask use and early and effective policy intervention to reintroduce some mandates as case and hospitalization rates get to a high level are the most important strategies for the winter ahead.

Current situation

- Daily reported cases in the last week decreased to 162,300 per day on average compared to 171,400 the week before (Figure 1). Interpreting this reported trend, however, is challenging, as a number of states have had challenges catching up to the lags in reporting from the Thanksgiving holiday.
- Daily deaths in the last week increased to 1,800 per day on average compared to 1,670 the week before (Figure 2). This makes COVID-19 the number 1 cause of death in the US this week (Table 1).
- Effective R, computed using cases, hospitalizations, and deaths, is greater than 1 in 15 states (Figure 3). There has been a substantial reduction in the trend in transmission in a number of Midwestern states.
- We estimated that 15% of people in the US have been infected as of December 7 (Figure 4).
- The daily death rate is greater than 4 per million in Alabama, Arizona, Arkansas, Colorado, Connecticut, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Jersey, New Mexico, North Dakota, Ohio, Oregon, Pennsylvania, Rhode Island, South Dakota, Tennessee, Texas, West Virginia, Wisconsin, and Wyoming (Figure 6).

Trends in drivers of transmission

- In the last week, new mandates have been imposed in North Dakota (Table 2).
- Mobility last week was more than 25% below the pre-COVID-19 baseline (Figure 8). Mobility was near baseline (within 10%) in no locations. Mobility was lower than 30% of baseline in California, Colorado, Connecticut, Delaware, Hawaii, Illinois, Maryland, Massachusetts, Michigan, Minnesota, Nevada, New Hampshire, New Jersey, New Mexico, New York, Oregon, Pennsylvania, Rhode Island, the District of Columbia, Utah, Vermont, Virginia, and Washington.
- As of December 7, we estimated that 73% of people always wore a mask when leaving their home (Figure 9). Mask use was lower than 50% in Wyoming.
- There were 394 diagnostic tests per 100,000 people on December 7 (Figure 10).
- The fraction of the population who are open to receiving a COVID-19 vaccine ranges from 68% in Alabama to 84% in California (Figure 12).
- 98.5 million people are expected to be vaccinated by April 1 (Figure 13). With faster scale-up, the number vaccinated could reach 228.75 million.

Projections

- In our **reference scenario**, which represents what we think is most likely to happen, our model projects 502,000 cumulative deaths on April 1, 2021. This represents 221,000 additional deaths from December 7 to April 1 (Figure 14). Daily deaths will peak at 2,460 on January 18, 2021 (Figure 15).
- The reference scenario assumes that 32 states will re-impose mandates by April 1, 2021.
- If **universal mask coverage (95%)** were attained in the next week, our model projects 56,000 fewer cumulative deaths compared to the reference scenario on April 1, 2021.
- Under our **mandates easing scenario**, our model projects 598,000 cumulative deaths on April 1, 2021.
- By April 1, 2021, we project that 25,200 lives will be saved by the projected vaccine rollout. If rapid rollout of vaccine is achieved, 44,500 lives will be saved compared to a no-vaccine scenario. Rapid rollout targeting high-risk individuals only could save, compared to a no-vaccine scenario, 49,900 lives.
- Figure 21 compares our reference scenario forecasts to other publicly archived models. Imperial now forecasts a peak of over 3,700 deaths a day in mid-January. Los Alamos and USC (SIKJalpha) suggest peaks of 3,000 deaths a day later, toward February. MIT (Delphi) has the lowest and earliest peak.

- 42 states will have high or extreme stress on hospital beds at some point in December through February (Figure 22). 48 states will have high or extreme stress on ICU capacity in December through February (Figure 23). States with extreme stress on ICUs sometime prior to April 1 include Arizona, California, Connecticut, Indiana, Kansas, Maryland, Minnesota, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Oregon, Pennsylvania, South Dakota, Utah, Virginia, and Wisconsin.

Model updates

See the briefs for December 4 (https://www.healthdata.org/covid/updates/archive) for details on how vaccination has been incorporated into our reference and alternative scenarios. In this week's release, we have revised some assumptions on vaccination based on the Pfizer FDA authorization filing. Using that new information, we now assume that 8 days after the first dose, the vaccine becomes 50% effective, increasing to 95% after the second dose.

Current situation

Figure 1. Reported daily COVID-19 cases

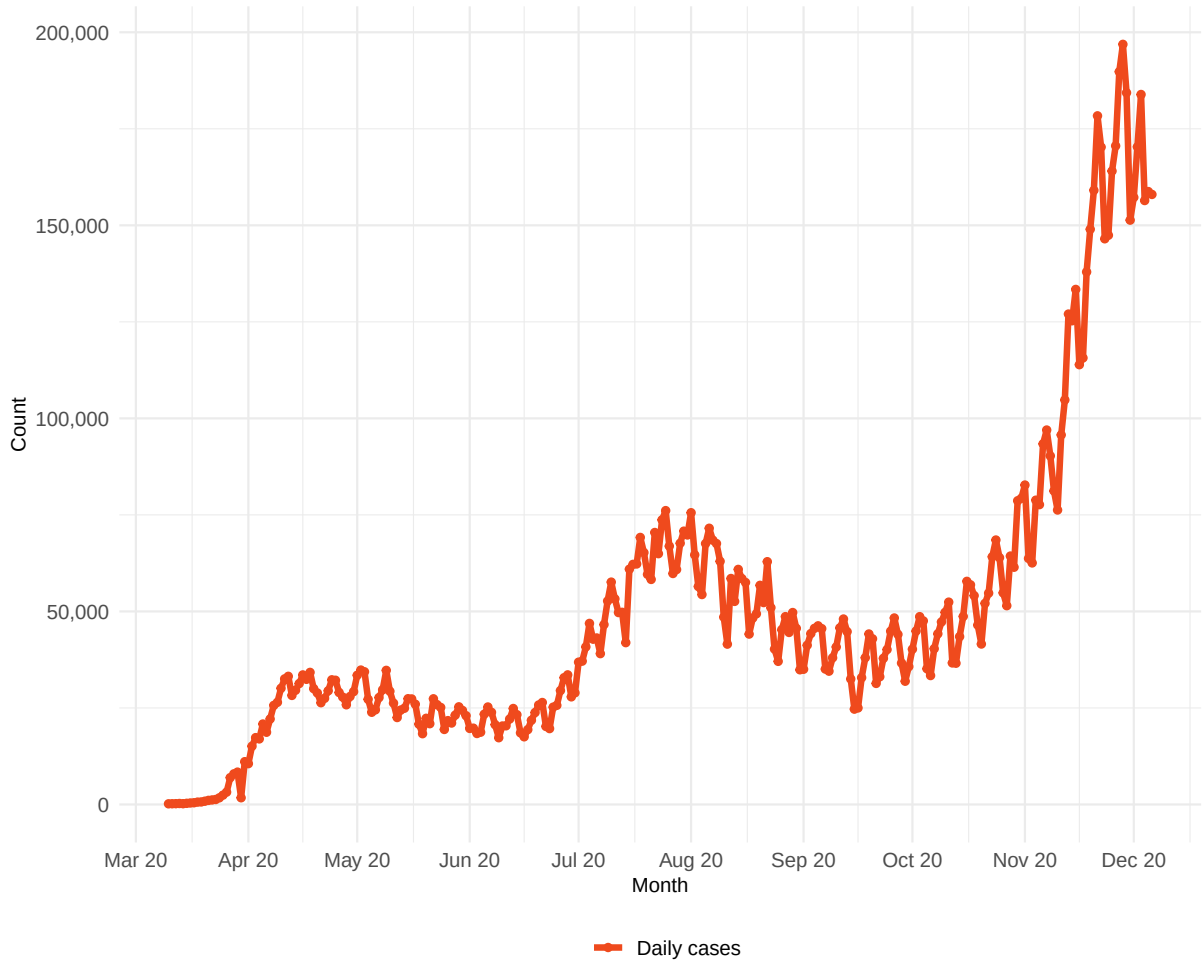


Table 1. Ranking of COVID-19 among the leading causes of mortality this week, assuming uniform deaths of non-COVID causes throughout the year

Cause name	Weekly deaths	Ranking
COVID-19	12,597	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 2a. Reported daily COVID-19 deaths

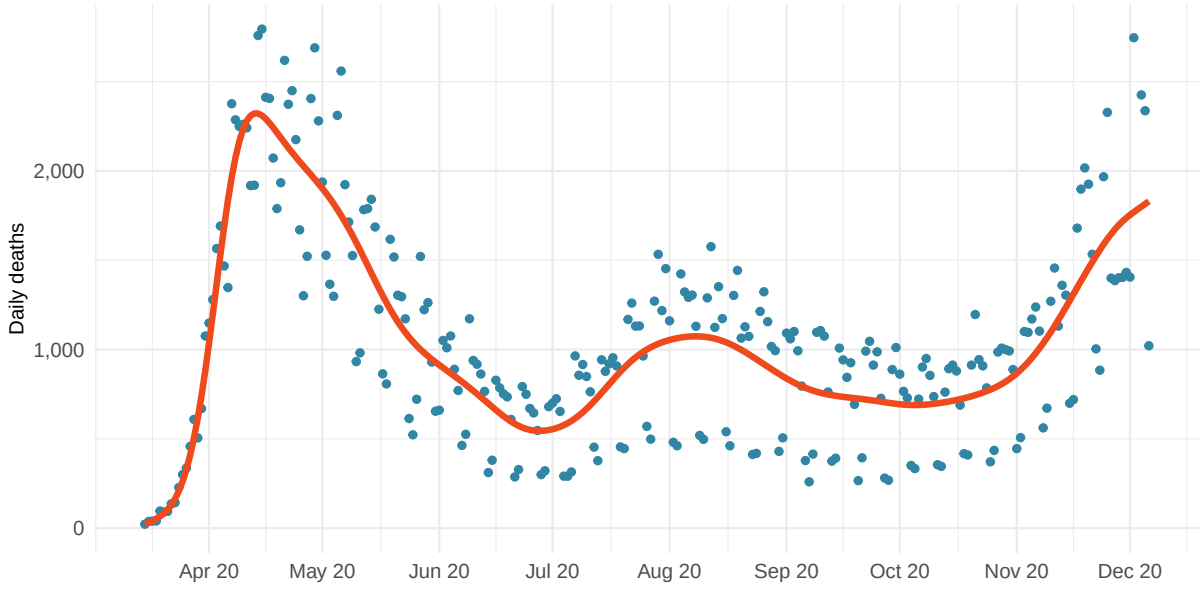


Figure 2b. Estimated cumulative deaths by age group

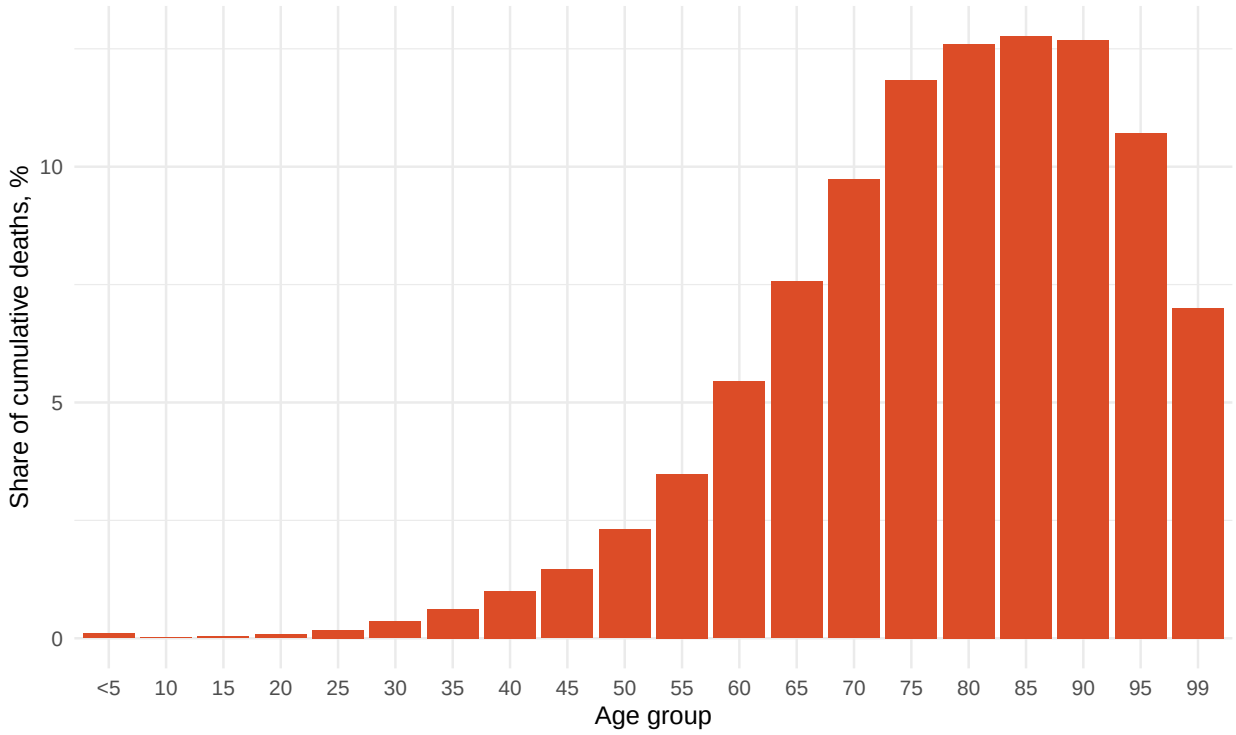


Figure 3. Mean effective R on November 26, 2020. The estimate of effective R is based on the combined analysis of deaths, case reporting, and hospitalizations where available. Current reported cases reflect infections 11-13 days prior, so estimates of effective R can only be made for the recent past. Effective R less than 1 means that transmission should decline, all other things being held the same.

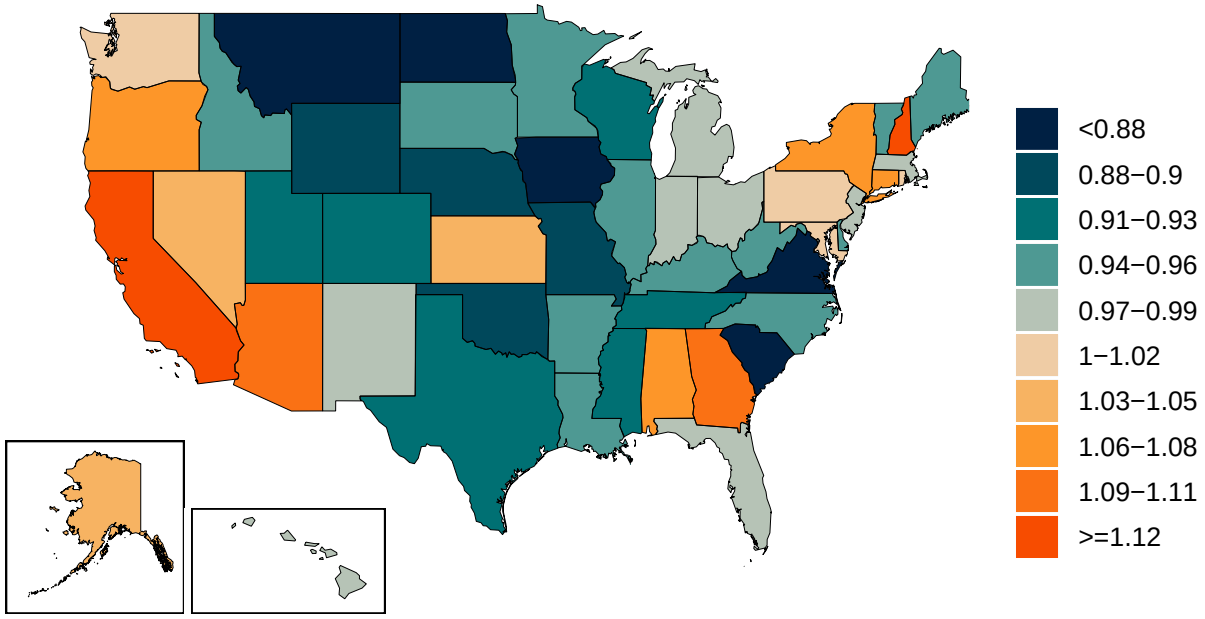


Figure 4. Estimated percent of the population infected with COVID-19 on December 07, 2020

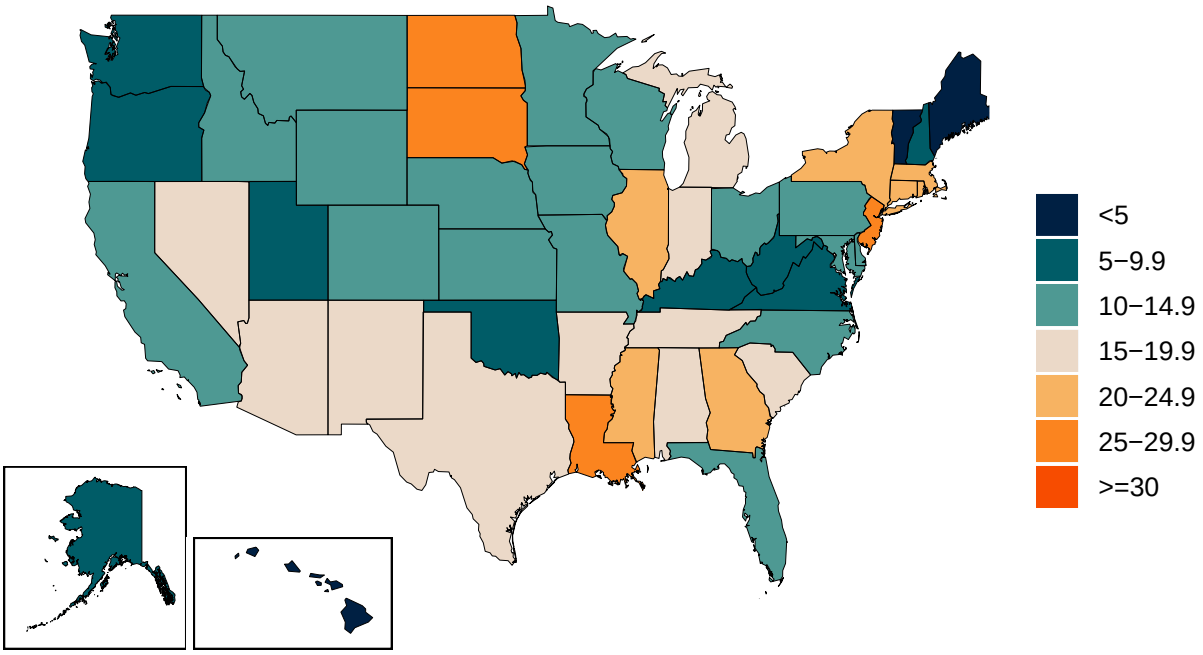


Figure 5. Percent of COVID-19 infections detected. This is estimated as the ratio of reported daily COVID-19 cases to estimated daily COVID-19 infections based on the SEIR disease transmission model.

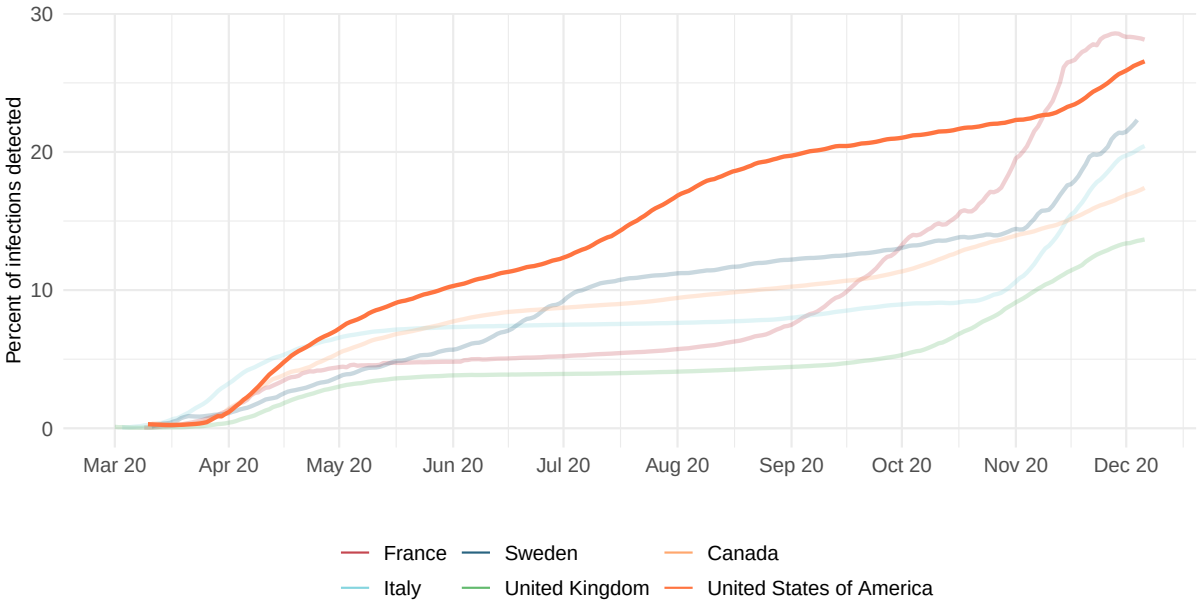
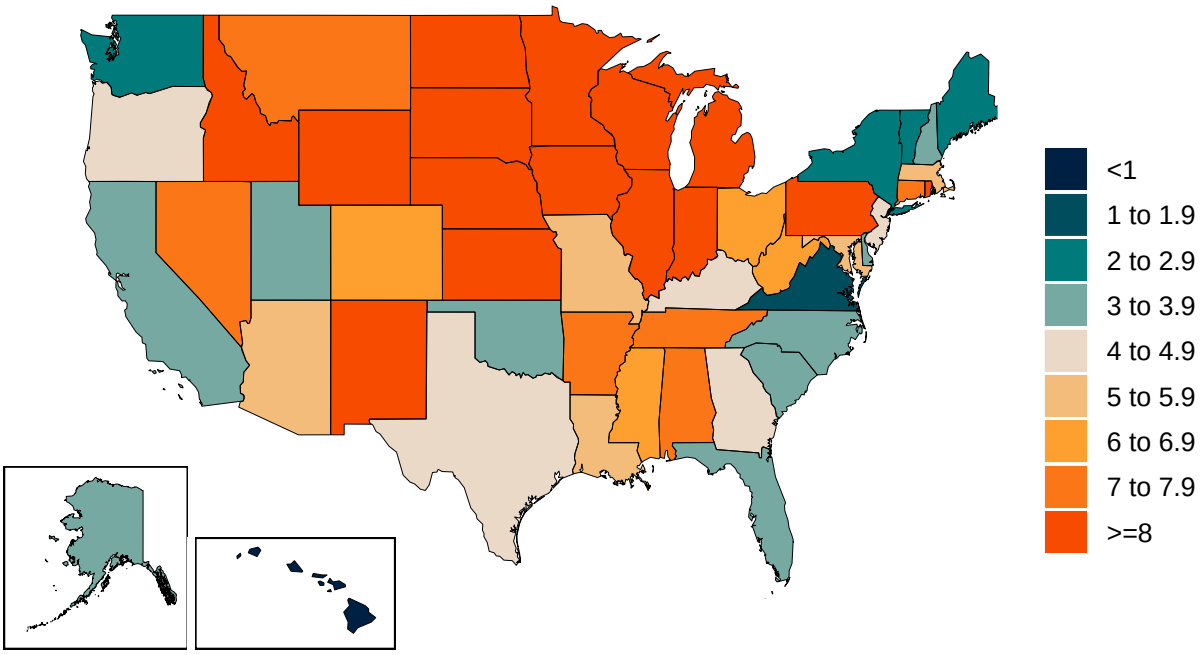


Figure 6. Daily COVID-19 death rate per 1 million on December 07, 2020



Critical drivers

Table 2. Current mandate implementation

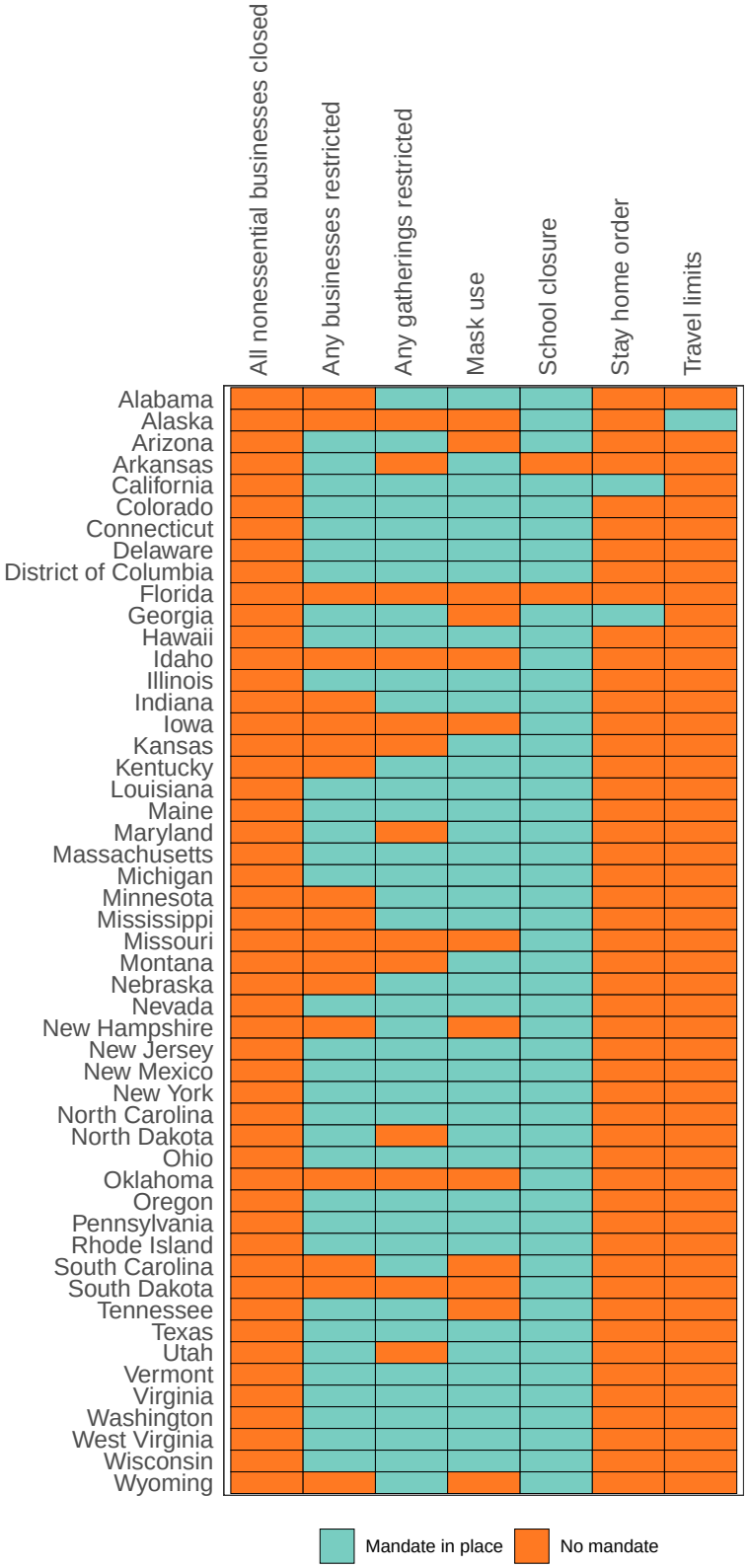


Figure 7. Total number of social distancing mandates (including mask use)

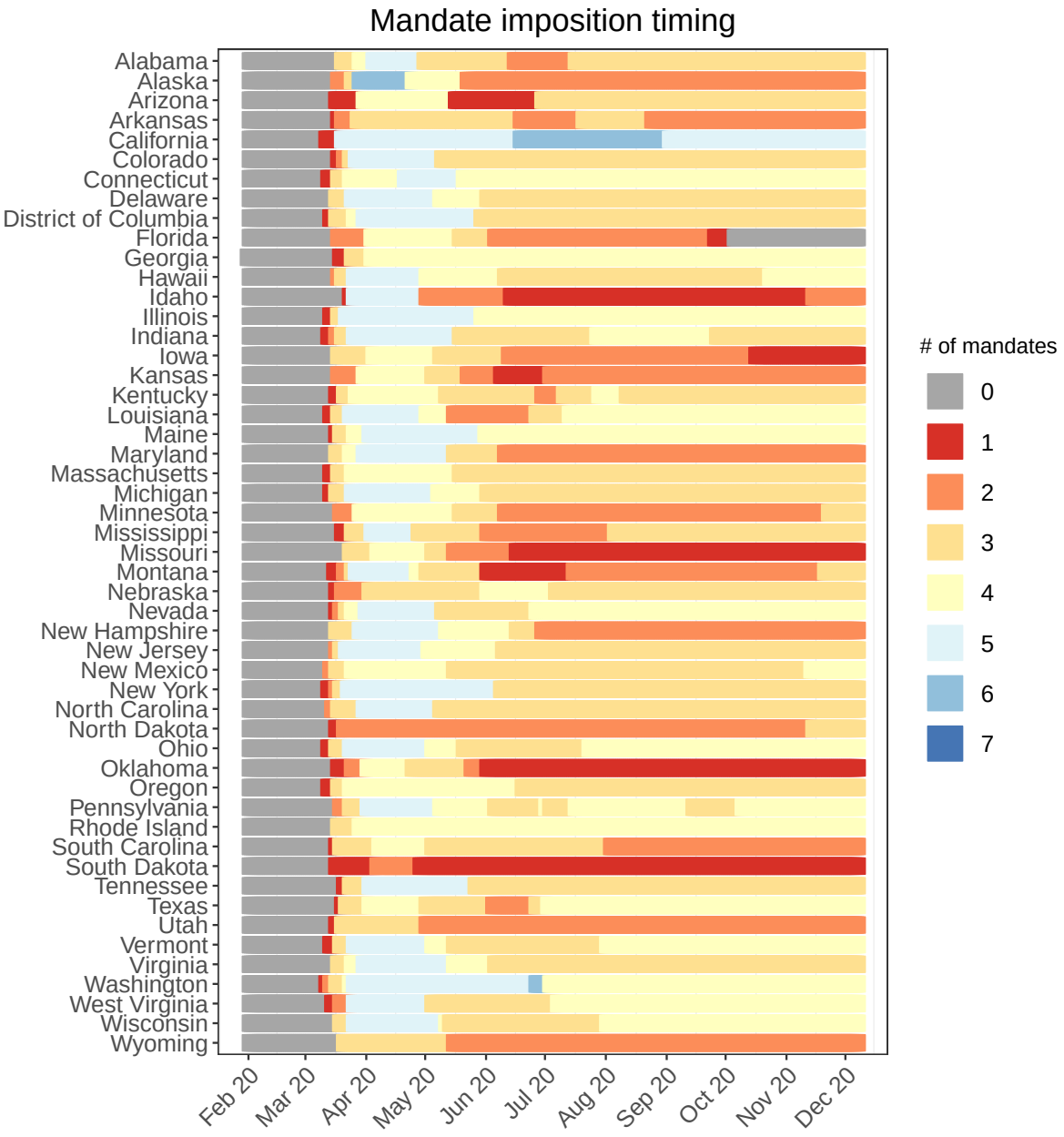


Figure 8a. Trend in mobility as measured through smartphone app use compared to January 2020 baseline

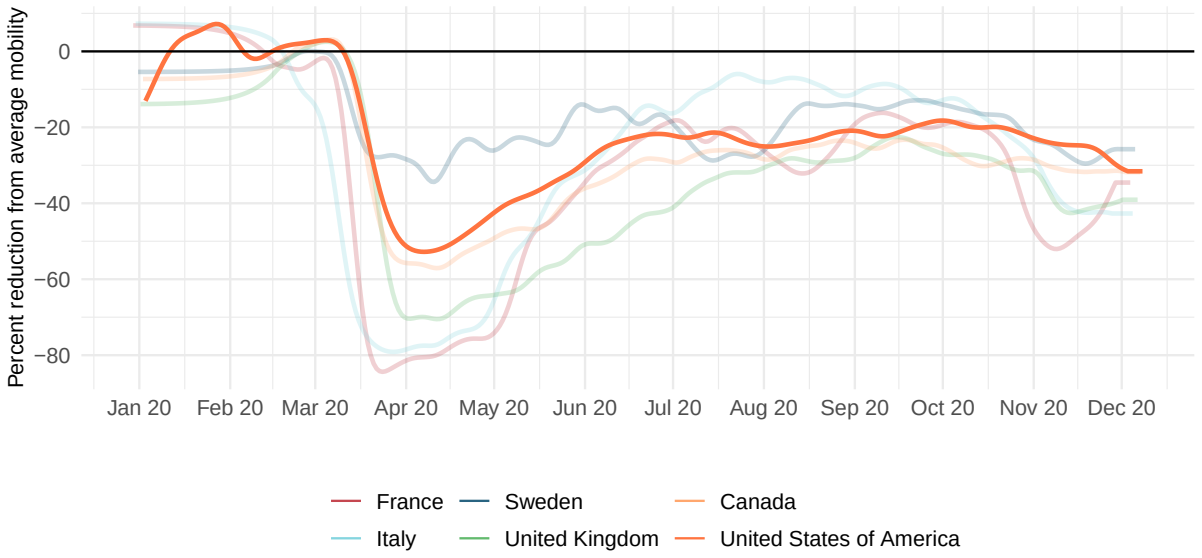


Figure 8b. Mobility level as measured through smartphone app use compared to January 2020 baseline (percent) on December 07, 2020

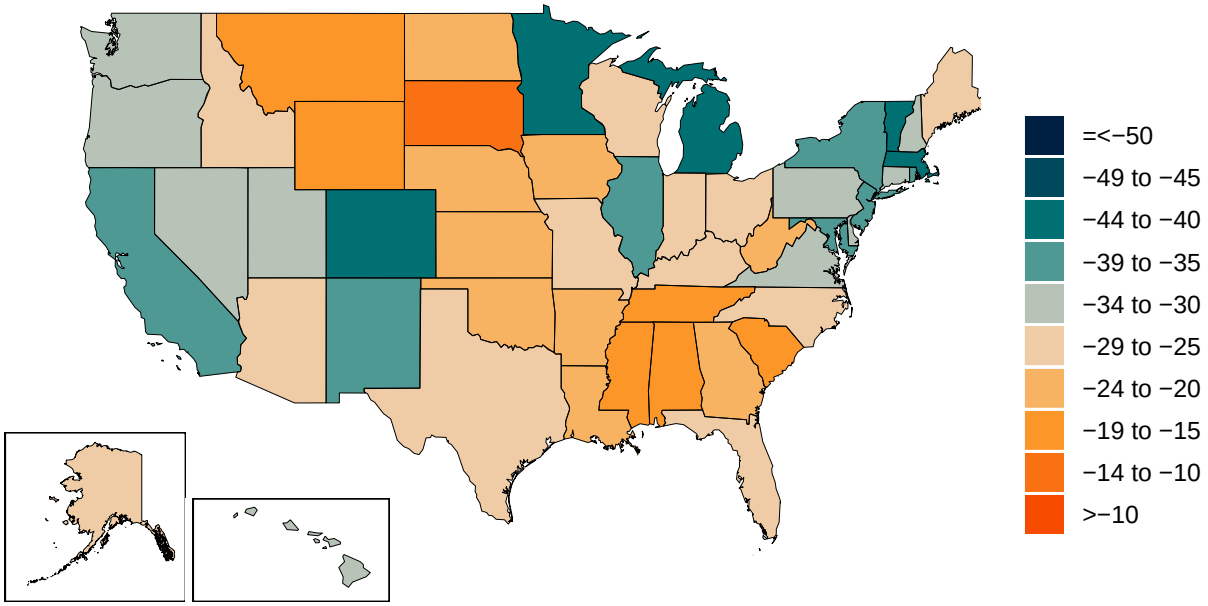


Figure 9a. Trend in the proportion of the population reporting always wearing a mask when leaving home

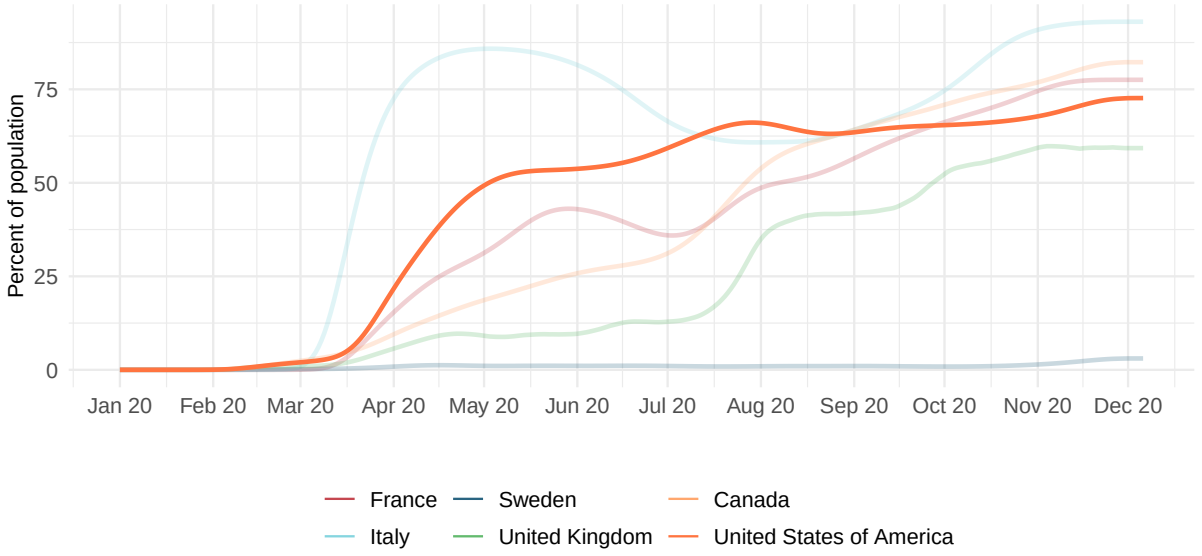


Figure 9b. Proportion of the population reporting always wearing a mask when leaving home on December 07, 2020

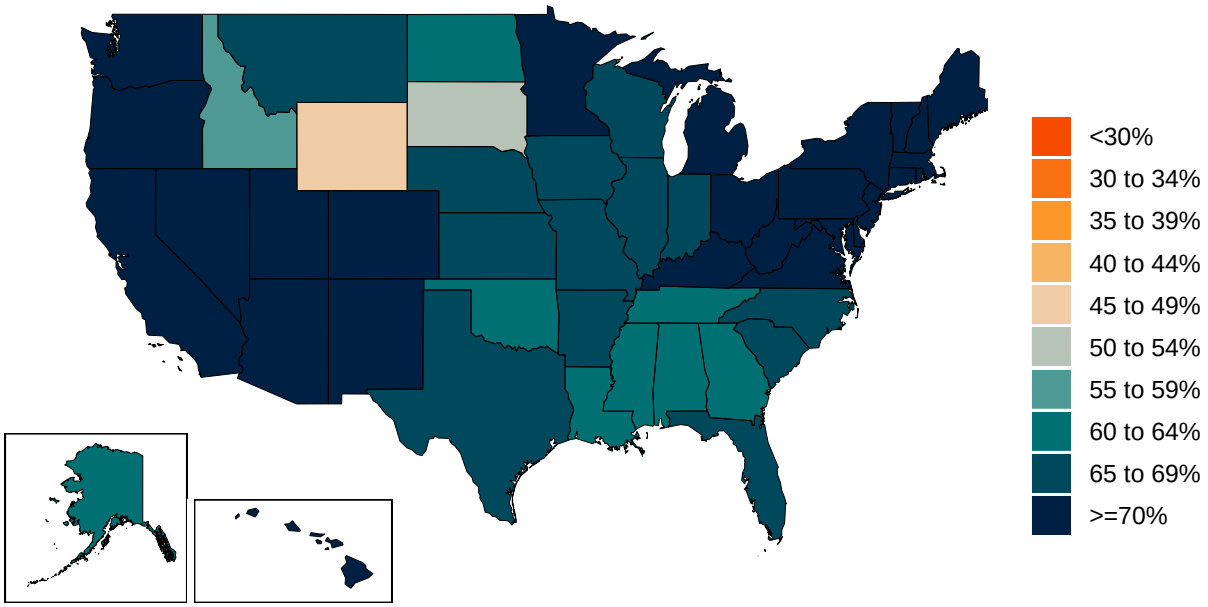


Figure 10a. Trend in COVID-19 diagnostic tests per 100,000 people

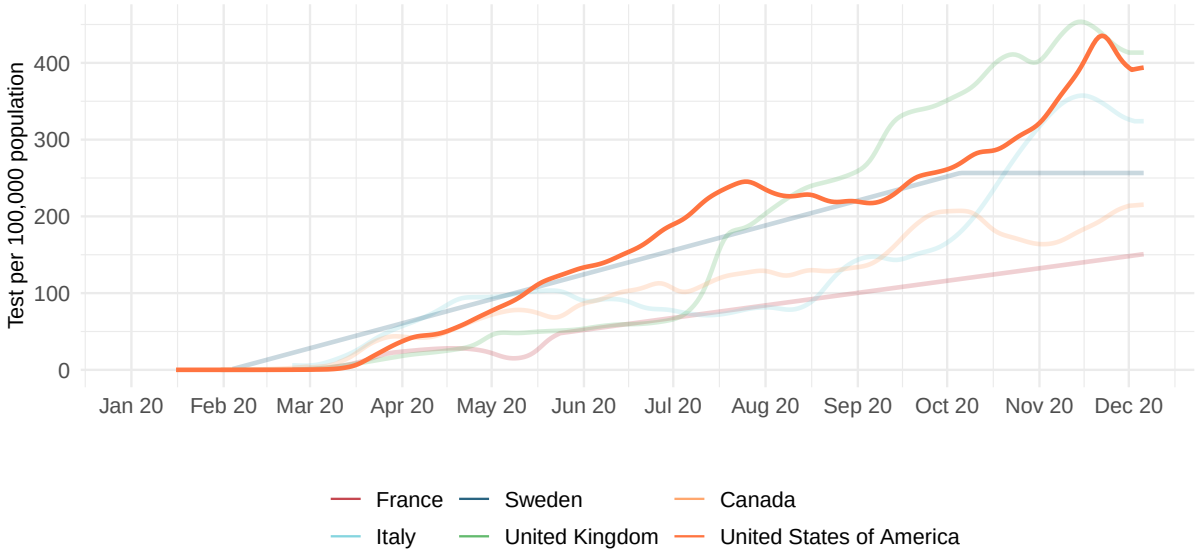


Figure 10b. COVID-19 diagnostic tests per 100,000 people on December 02, 2020

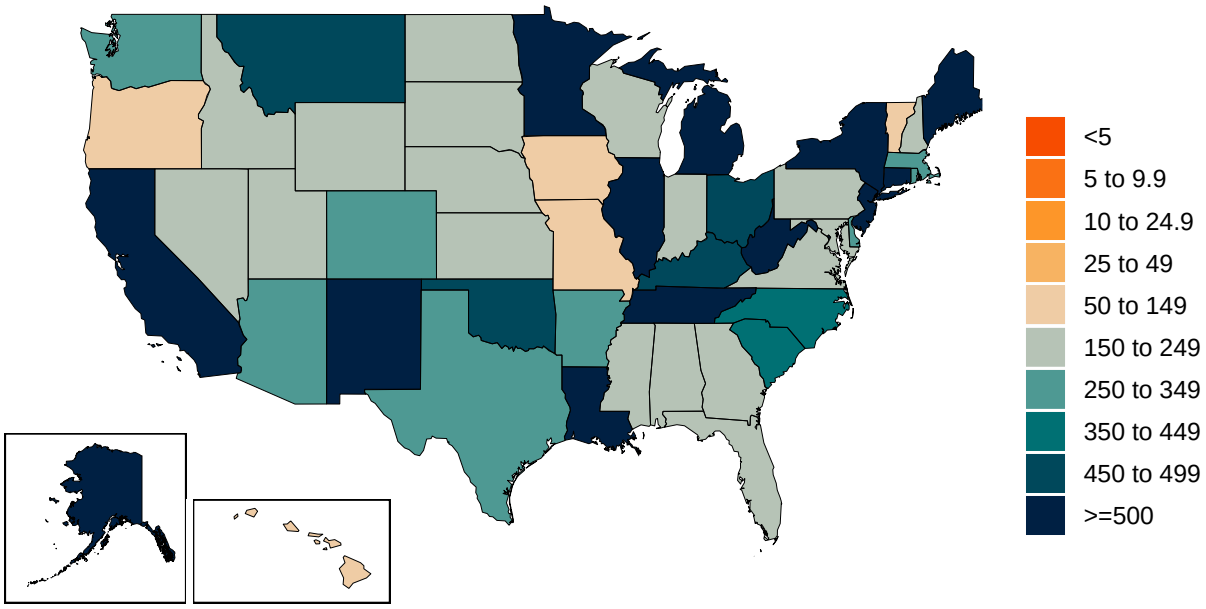


Figure 11. Increase in the risk of death due to pneumonia on February 1 2020 compared to August 1 2020

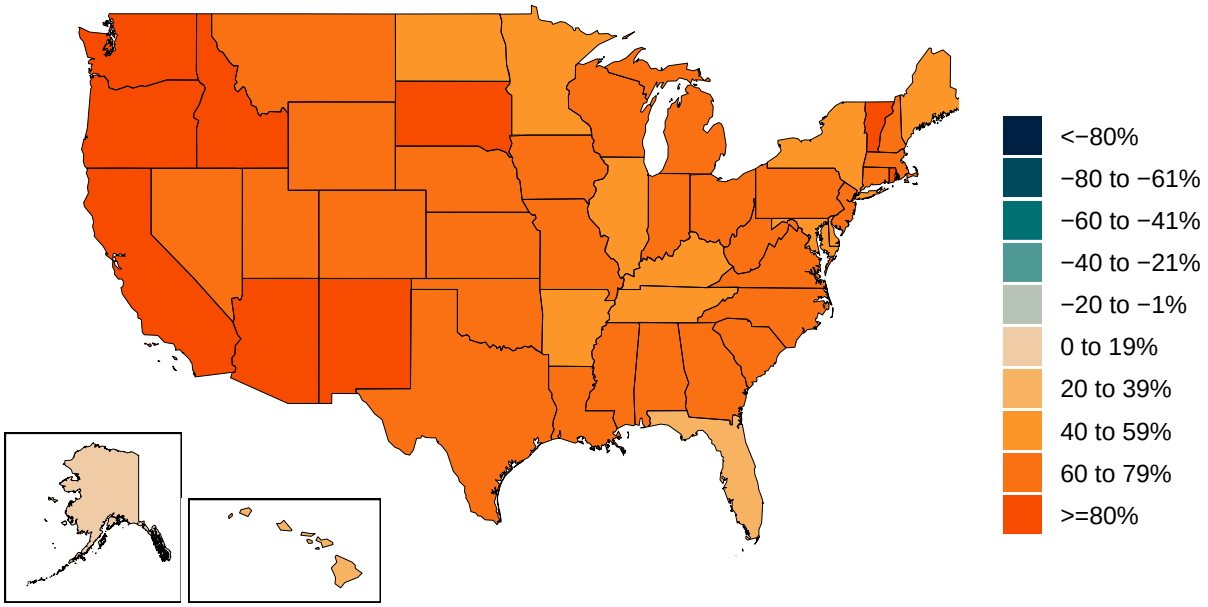


Figure 12. This figure shows the estimated proportion of the adult (18+) population that is open to receiving a COVID-19 vaccine based on Facebook survey responses

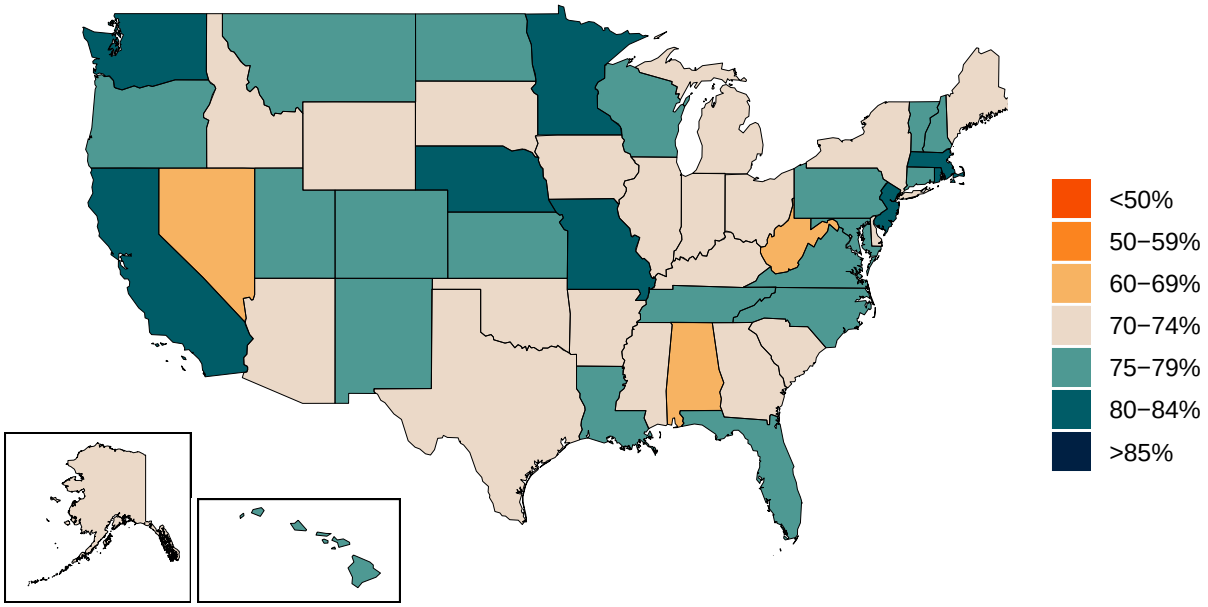
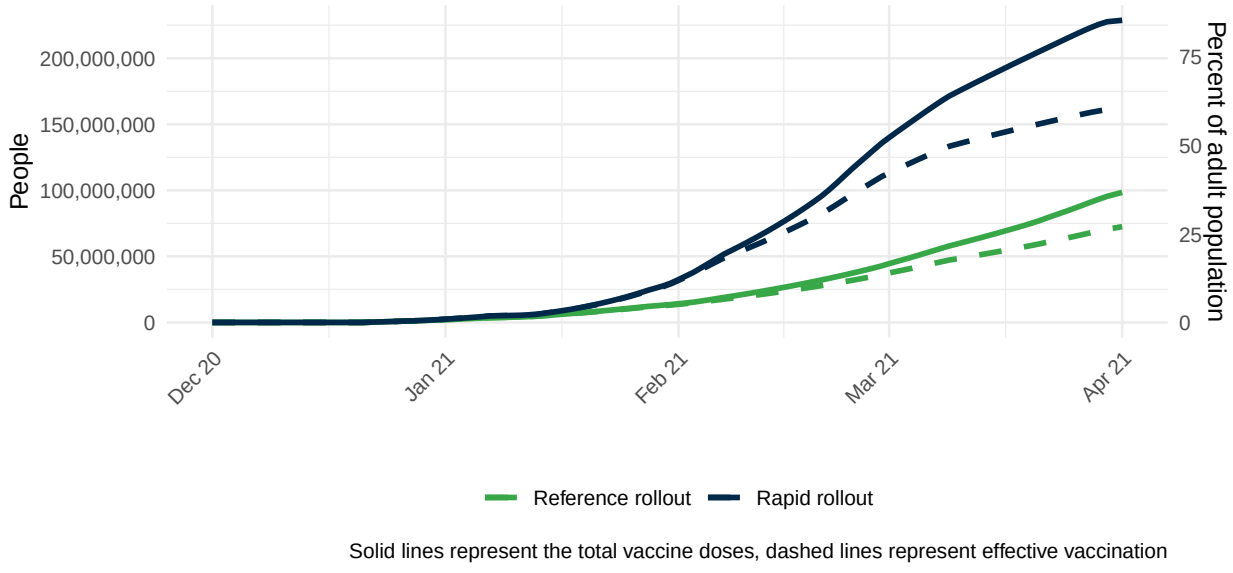


Figure 13. The number of people who receive any vaccine and those that are immune accounting for efficacy, loss to follow up for 2 dose vaccines, and a 28 day delay between first dose and immunity for 2 dose vaccines.



Projections and scenarios

We produce six scenarios when projecting COVID-19. The reference scenario is our forecast of what we think is most likely to happen. We assume that if the daily mortality rate from COVID-19 reaches 8 per million, social distancing (SD) mandates will be re-imposed. The mandate easing scenario is what would happen if governments continue to ease social distancing mandates with no re-imposition. The universal mask mandate scenario is what would happen if mask use increased immediately to 95% and social distancing mandates were re-imposed at 8 deaths per million. These three scenarios assume our reference vaccine delivery scale up where vaccine delivery will scale to full capacity over 90 days.

The rapid vaccine rollout scenario assumes that vaccine distribution will scale up to full delivery capacity in half the time as the reference delivery scenario and that the maximum doses that can be delivered per day is twice as much as the reference delivery scenario. The rapid vaccine rollout to high-risk populations scenario is the same but high-risk populations are vaccinated before essential workers or other adults. The no vaccine scenario is the same as our reference scenario but with no vaccine use.

Figure 14. Cumulative COVID-19 deaths until April 01, 2021 for six scenarios

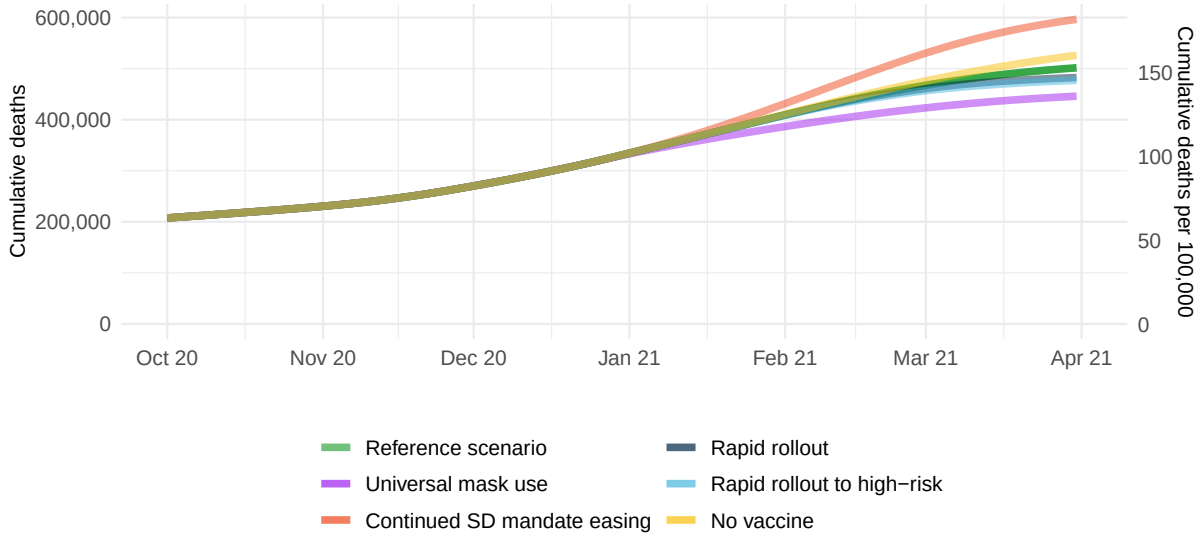


Figure 15. Daily COVID-19 deaths until April 01, 2021 for six scenarios

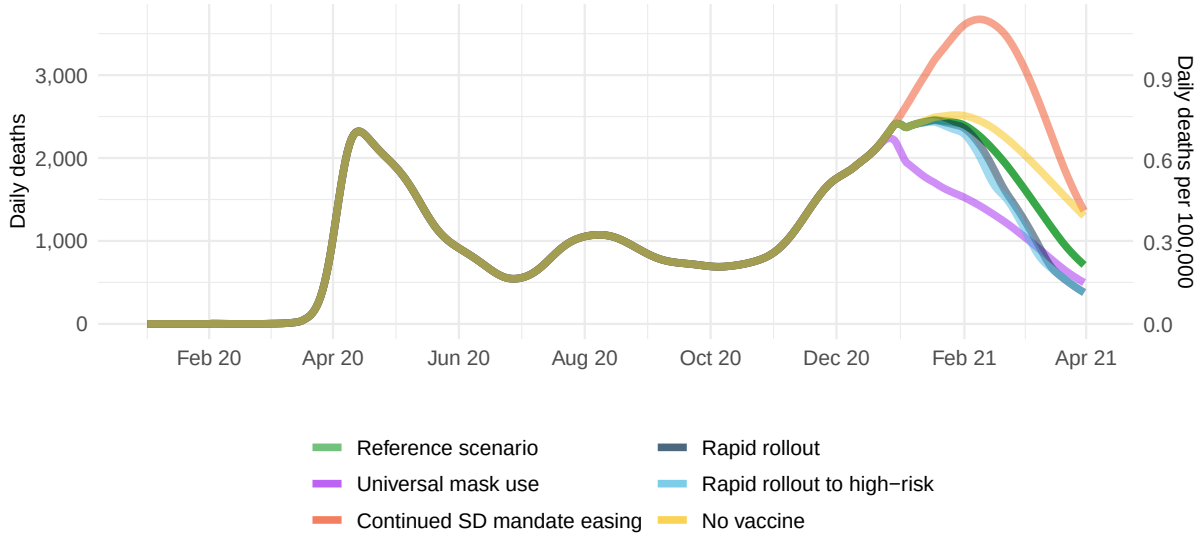


Figure 16. Daily COVID-19 infections until April 01, 2021 for six scenarios

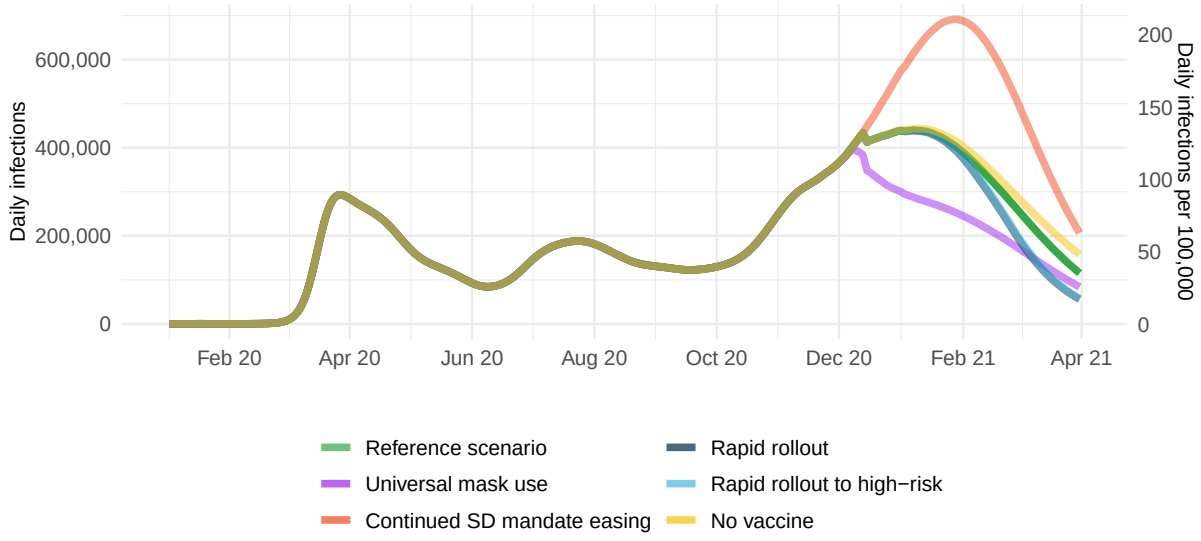


Figure 17. Susceptible population, accounting for infections and people immune through vaccination

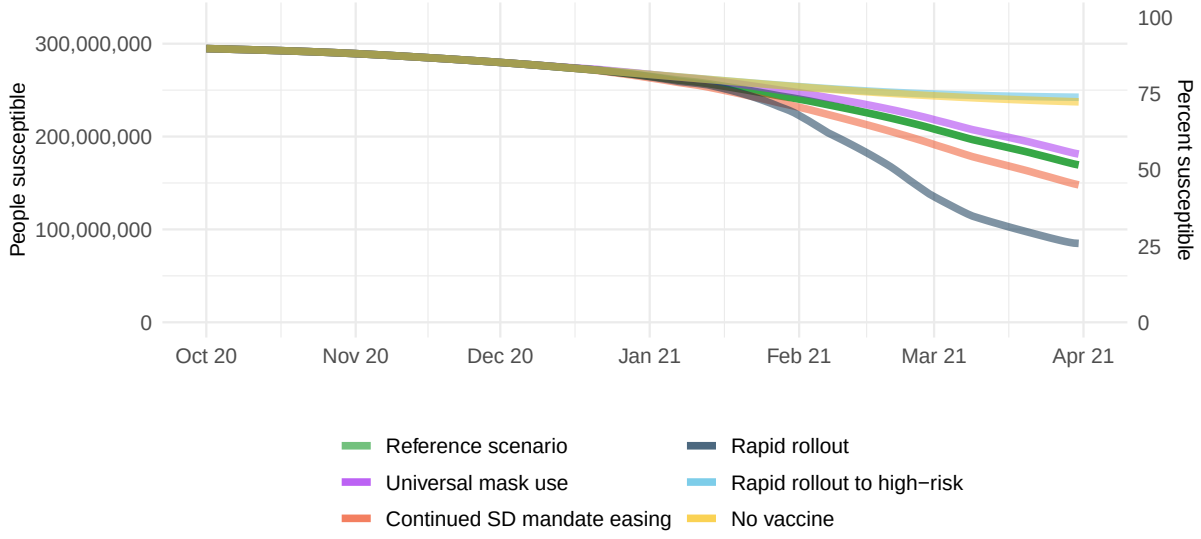


Figure 18. Month of assumed mandate re-implementation. (Month when daily death rate passes 8 per million, when reference scenario model assumes mandates will be re-imposed.)

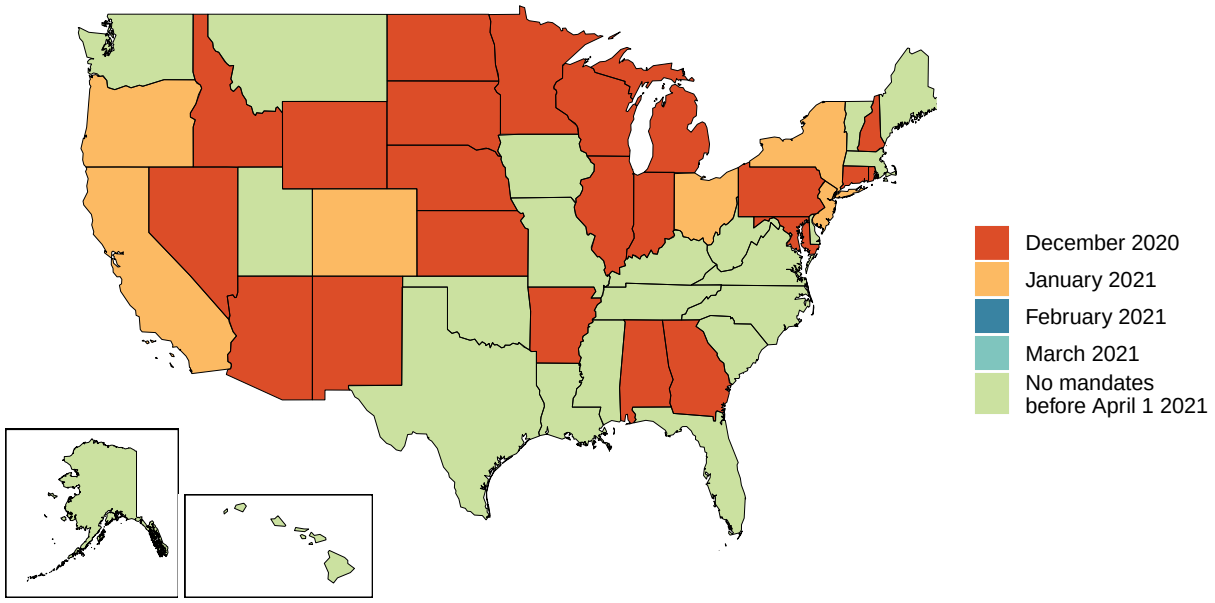


Figure 19. Forecasted percent infected with COVID-19 on April 01, 2021

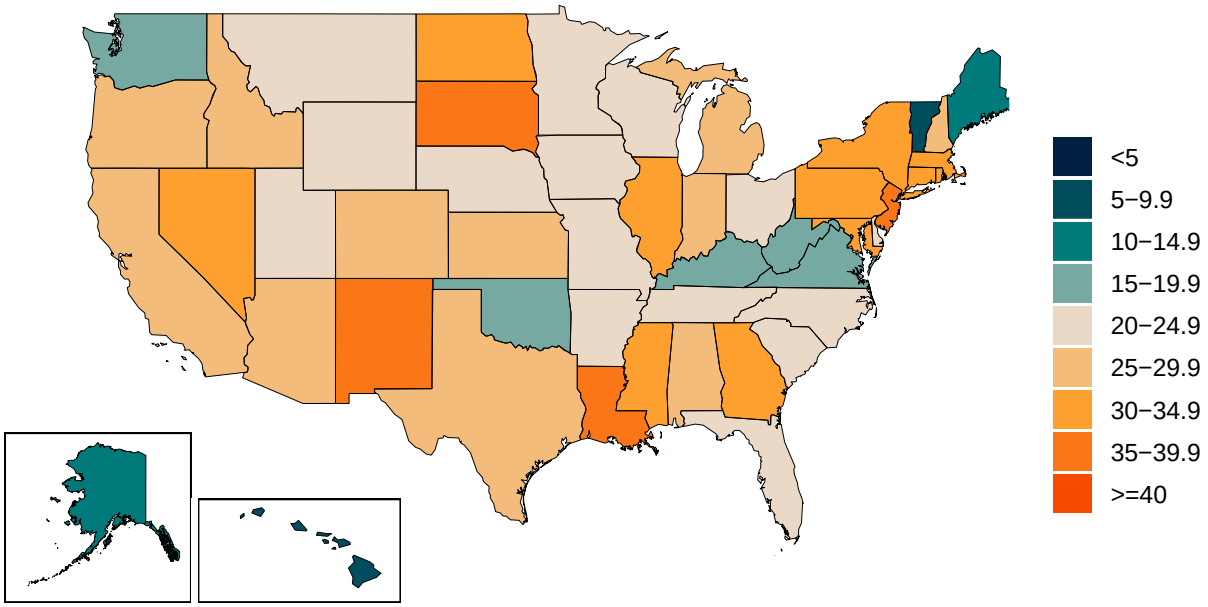


Figure 20. Daily COVID-19 deaths per million forecasted on April 01, 2021 in the reference scenario

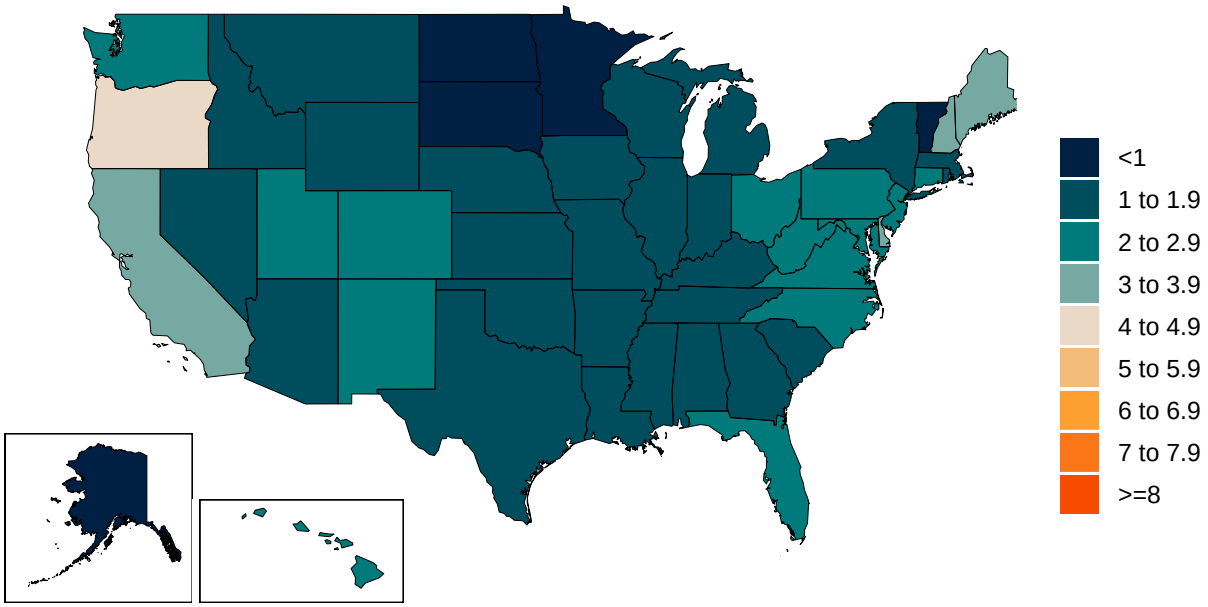


Figure 21. Comparison of reference model projections with other COVID modeling groups. For this comparison, we are including projections of daily COVID-19 deaths from other modeling groups when available: Delphi from the Massachussets Institute of Technology (Delphi; https://www.covidanalytics.io/home), Imperial College London (Imperial; https://www.covidsim.org), The Los Alamos National Laboratory (LANL; https://covid-19.bsvgateway.org/), 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 availble locations in that region.

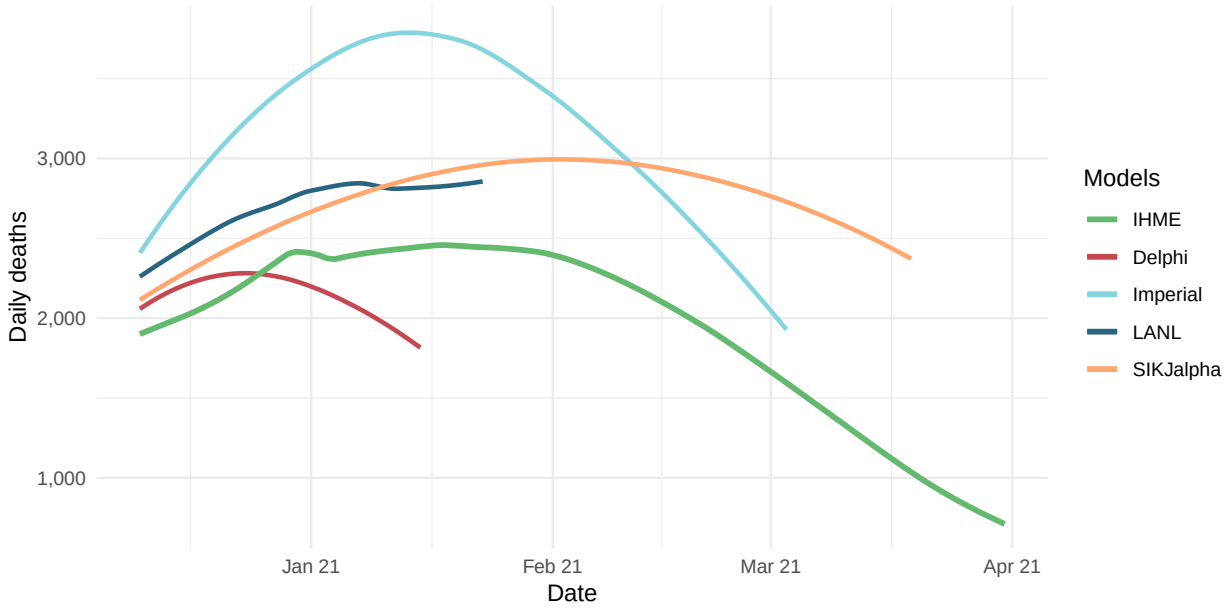


Figure 22. The estimated inpatient hospital usage is shown over time. The percent of hospital beds occupied by COVID-19 patients is color coded based on observed quantiles of the maximum proportion of beds occupied by COVID-19 patients. Less than 5% is considered *low stress*, 5-9% is considered *moderate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

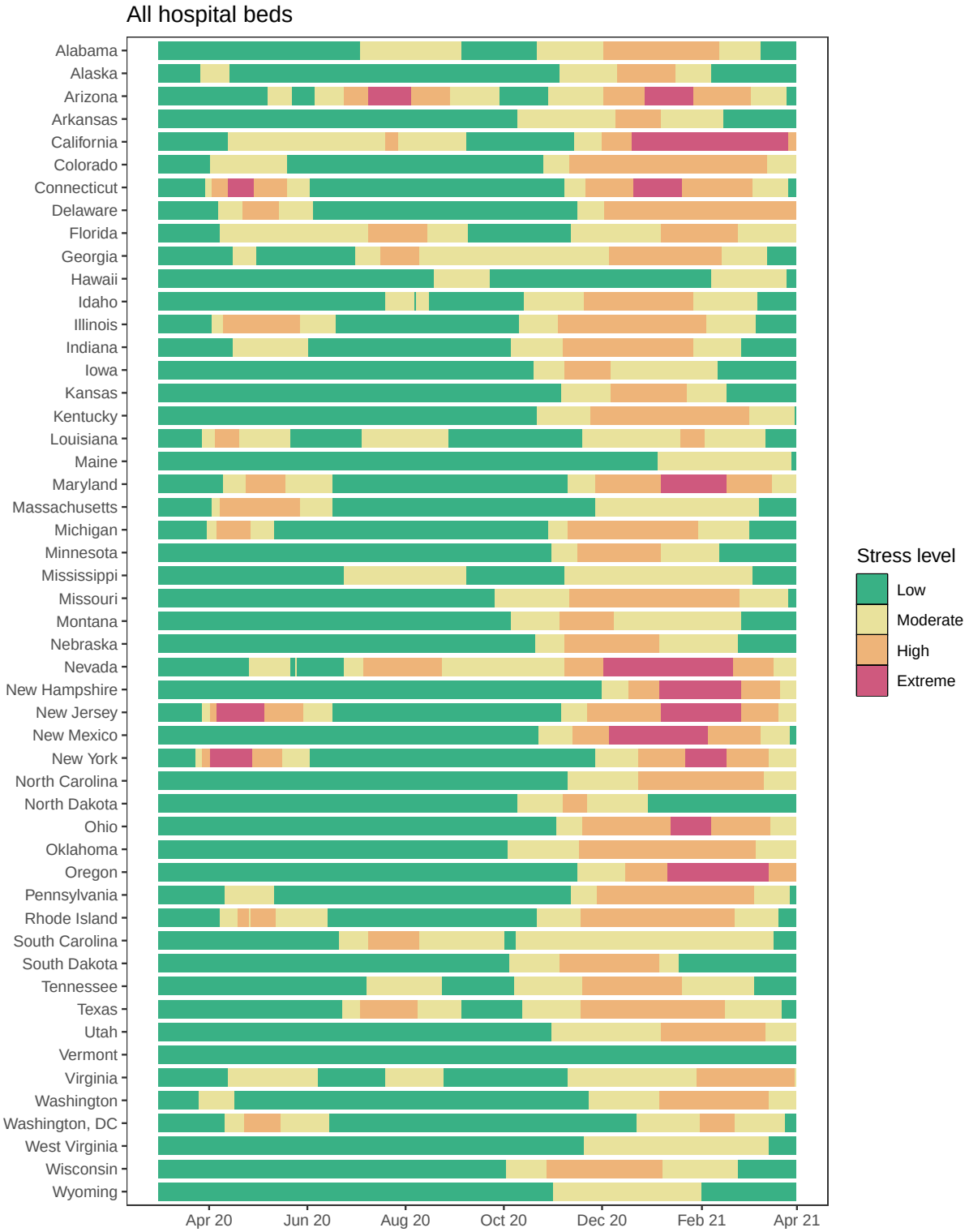


Figure 23. The estimated intensive care unit (ICU) usage is shown over time. The percent of ICU beds occupied by COVID-19 patients is color coded based on observed quantiles of the maximum proportion of ICU beds occupied by COVID-19 patients. Less than 10% is considered *low stress*, 10-29% is considered *moderate stress*, 30-59% is considered *high stress*, and greater than 60% is considered *extreme stress*.

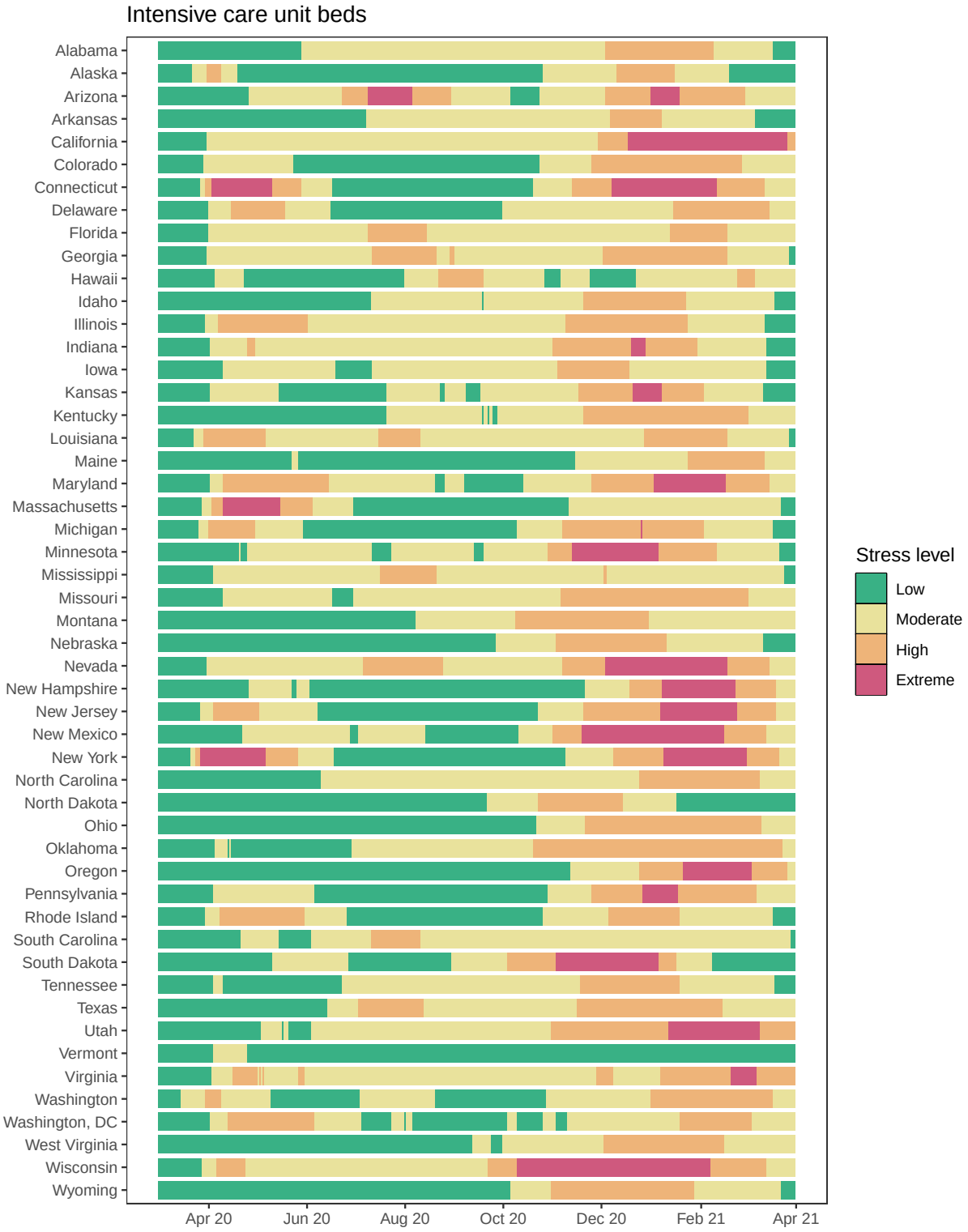


Table 3. Ranking of COVID-19 among the leading causes of mortality in the full year 2020. Deaths from COVID-19 are projections of cumulative deaths on Jan 1, 2021 from the reference scenario. Deaths from other causes are from the Global Burden of Disease study 2019 (rounded to the nearest 100).

Cause name	Annual deaths	Ranking
Ischemic heart disease	557,600	1
COVID-19	334,454	2
Tracheal, bronchus, and lung cancer	206,200	3
Chronic obstructive pulmonary disease	195,800	4
Stroke	189,500	5
Alzheimer's disease and other dementias	143,900	6
Chronic kidney disease	107,000	7
Colon and rectum cancer	84,000	8
Lower respiratory infections	81,900	9
Diabetes mellitus	77,700	10

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/).

Data on vaccine candidates, stages of development, manufacturing capacity, and pre-purchasing agreements are primarily from Linksbridge and supplemented by Duke University.

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.