Cases have stayed constant but deaths have been steadily declining in the last week. Our forecasts of cumulative deaths by January 1 have declined to 378,000, down from 415,000 as of the last projection on September 10. Even if herd immunity were to occur at a low level, such as 40% (the level seen in Mexico City now) with cumulative infections, by January 1, the US epidemic would only be less than half over.

Current situation

- Confirmed cases remain relative constant since the end of August (Figure 1).
- Daily deaths have been steadily declining, reaching 650 per day in the last week, although COVID-19 remains the second leading cause of death in the nation (Figure 2 and Table 1).
- Effective R based on the combined analysis of cases, hospitalizations, and deaths remains above 1 in Nebraska, Kansas, Tennessee, and New Jersey (Figure 3).
- Given widespread discussion of the possibility of herd immunity at low levels of cumulative infection in the US, we note that New Jersey has already reached a cumulative percentage infected of 25%, still well below the levels of greater than 40% seen in Mexico City, Ecuador, and parts of Brazil (Figure 4).

Trends in key drivers of transmission (mobility, mask use, testing, and seasonality)

- In the last week, the only change in state-level mandates was an easing of educational restrictions in West Virginia and removal of a mask mandate in Alaska (Table 2).
- The longer-term trend in mobility has remained quite constant in the last week. Some cell phone data suggest a substantial decline over the Labor Day weekend, similar to the decline seen on the July 4th holiday. We do not expect this decline to be sustained in the next week so it has not been included in this analysis
- There is slightly less of a decline in mask use as compared to one week prior (Figure 9).

Projections

- Our forecast of cumulative deaths by January 1 has declined from 415,000 on September 10 to 378,320 today. This decline is driven by steeper than expected declines seen in deaths in several states. In our model, these declines push out further into January and February the expected seasonal surge, reducing the number of deaths expected by January 1. We expect over 3,000 deaths per day by the end of December.
- Between now and January 1 we expect approximately 180,000 deaths. Increasing mask use to 95% can save nearly 115,000 lives, reducing that expected number of deaths by 62.7%.

Model updates

- With each re-estimation of the regression coefficients over the last 3 months for predicting b(t), the transmission parameter, the coefficient on testing per capita has tended to get closer to 0. In many of the 1,000 models, the coefficient is now 0. This declining role of testing in reducing transmission seen empirically may have several explanations. First, many tests are being conducted but results are not being returned fast enough to impact transmission. Second, since most testing is still in symptomatic individuals, testing per capita may be poorly correlated with actual testing of contacts that may have a larger impact on reducing transmission. Third, when the epidemic starts to increase, testing of symptomatic individuals increases and vice versa.
- Given considerable public discussion of the role of herd immunity in explaining peaks and subsequent declines in the daily death and case rates, we have explored the implied total death rate for each state based on the infection-fatality rate (IFR) and different assumptions about the level of cumulative infection that will be associated with herd immunity. The natural experiment of the Charles de Gaulle aircraft carrier suggests that up to 70% of individuals can get infected in a situation of near-random mixing. But various theories, including the

role of super-spreaders, non-random mixing in less dense populations, non-overlapping social networks, and some prior coronavirus immunity, have led to the belief that herd immunity may take place at much lower levels of cumulative infection.

- In social media, there are unsupported claims that herd immunity may occur at levels below 20% cumulative infection. However, in the US, New Jersey is already at 25%, and multiple locations in Latin America are now at over 40%. Our IFR based on the analysis of seroprevalence data and herd immunity at 40% cumulative infection would suggest the US will eventually see 815,000 deaths; with herd immunity at 50% cumulative infection, the figure would be 1,018,000 deaths, and at 65% it would be 1,324,000 deaths. Scale-up of a vaccine or improved treatments could substantially reduce these estimates. These calculations only serve to suggest that the epidemic in the US is far from complete and, even in the optimistic scenario of herd immunity kicking in at 40% cumulative infection, is less than halfway through the epidemic on January 1.

IHME wishes to warmly acknowledge the support of these and others who have made our COVID-19 estimation efforts possible. Thank you.

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.

COVID-19 Results Briefing: United States of America

Institute for Health Metrics and Evaluation (IHME)

September 17, 2020

This briefing contains summary information on the latest projections from the IHME model on COVID-19 in United States of America. The model was run on September 16, 2020.

Model updates

Updates to the model this week include additional data on deaths, cases, and updates on covariates.

Current situation

Figure 1. Reported daily COVID-19 cases

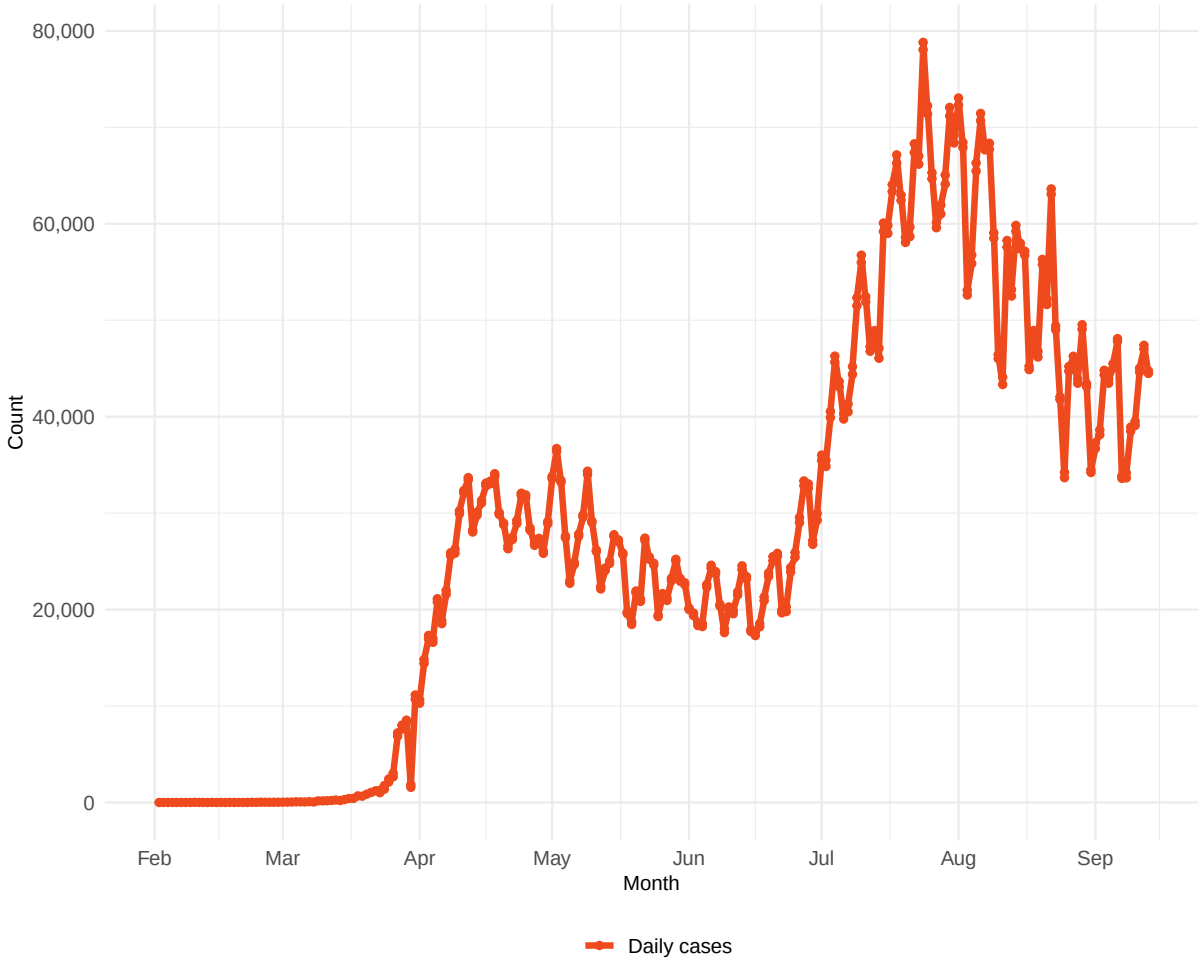


Table 1. Ranking of COVID-19 among the leading causes of mortality this week, assuming uniform deaths of non-COVID causes throughout the year

Cause name	Weekly deaths	Ranking
Ischemic heart disease	10,724	1
COVID-19	4,551	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 and smoothed trend estimate

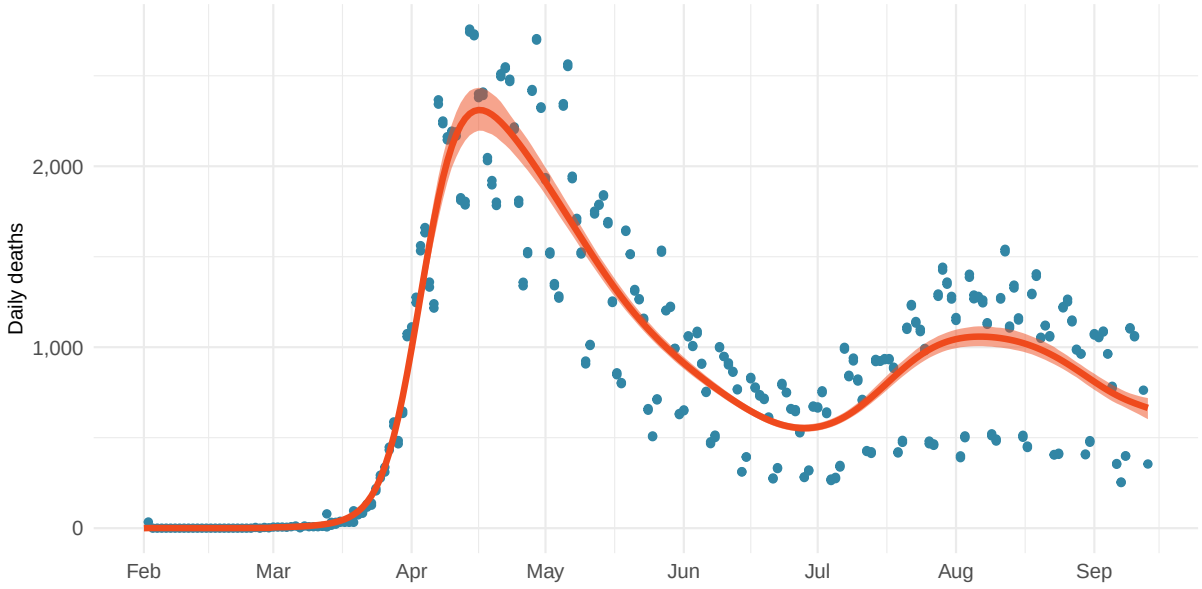


Figure 2b. Estimated cumulative deaths by age group

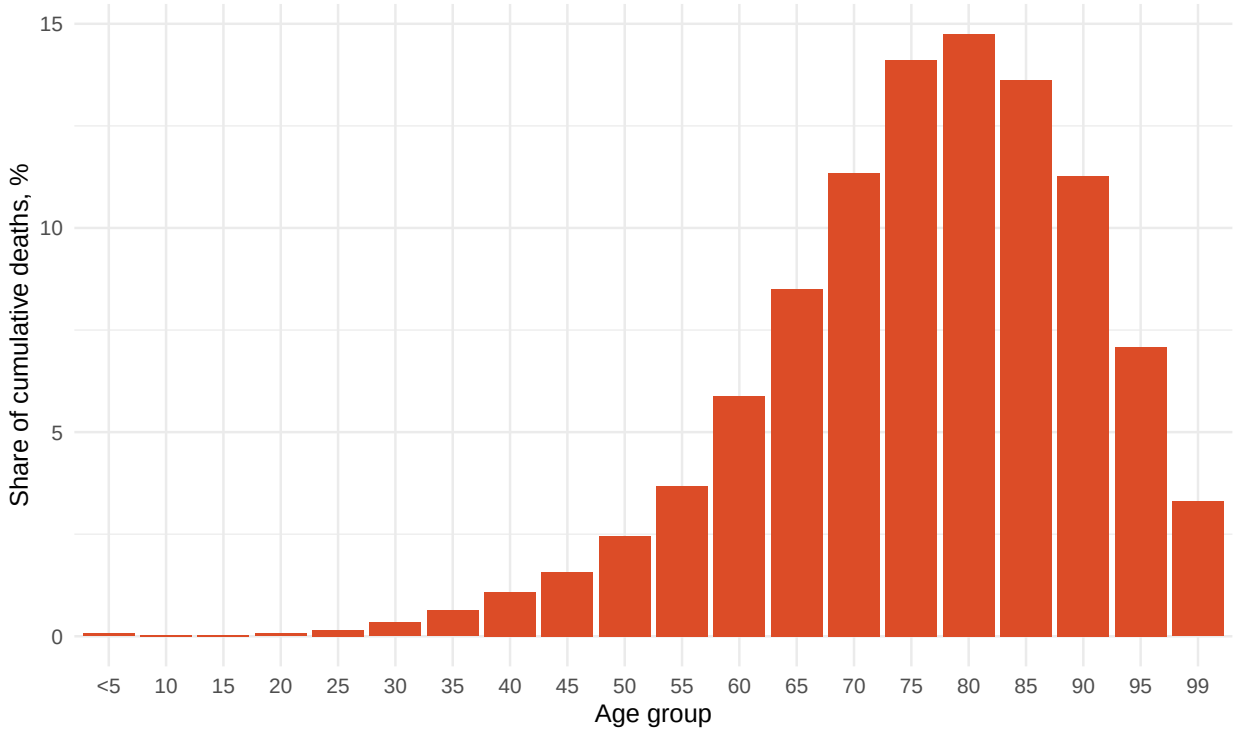


Figure 3. Mean effective R on September 03, 2020. The estimate of effective R is based on the combined analysis of deaths, case reporting and hospitalizations where available. Current reported cases reflect infections 11-13 days prior so estimates of effective R can only be made for the recent past. Effective R less than 1 means that transmission should decline all other things being held the same.

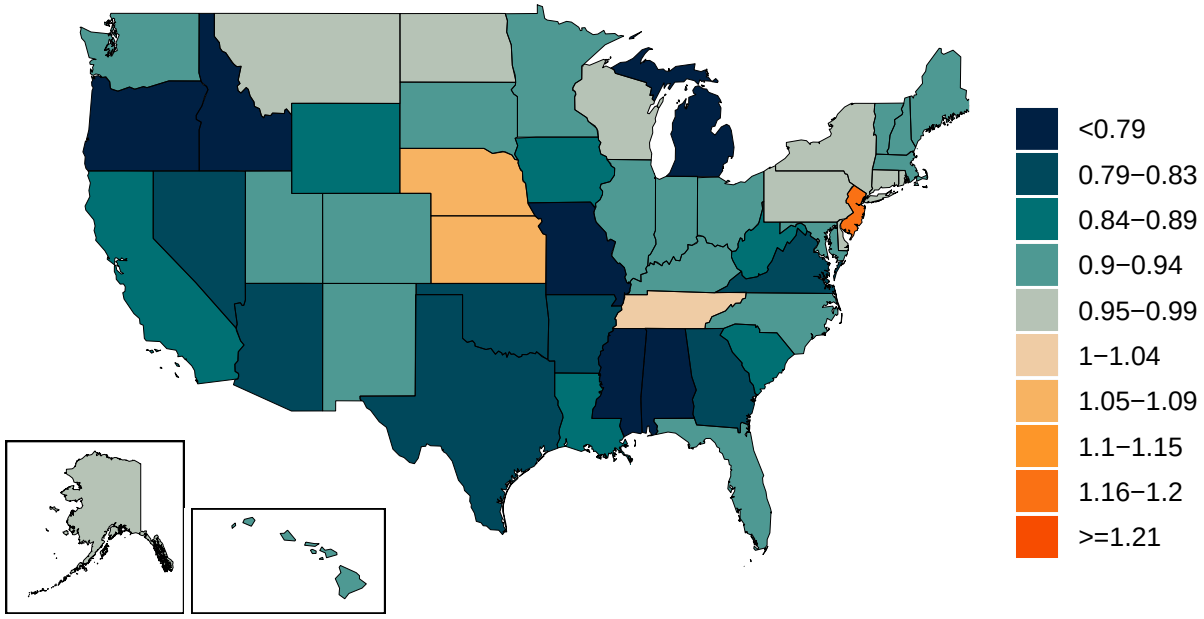


Figure 4. Estimated percent infected with COVID-19 on September 14, 2020

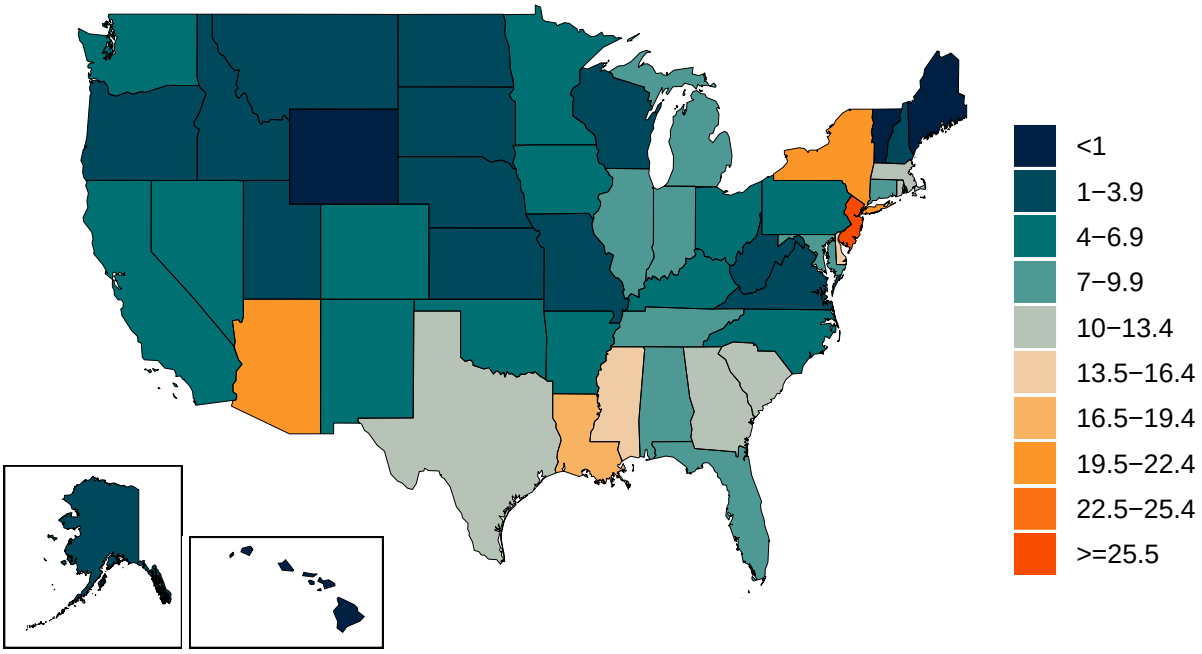


Figure 5. Percent of COVID-19 infections detected. This is estimated as the ratio of reported COVID-19 cases to estimated COVID-19 infections based on the SEIR model.

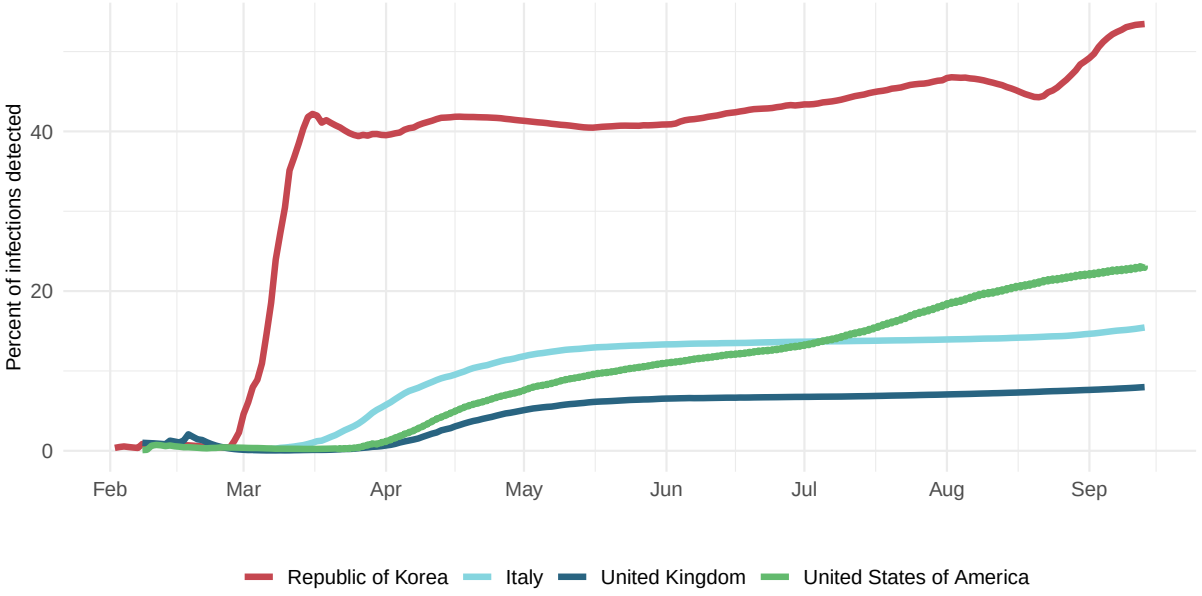
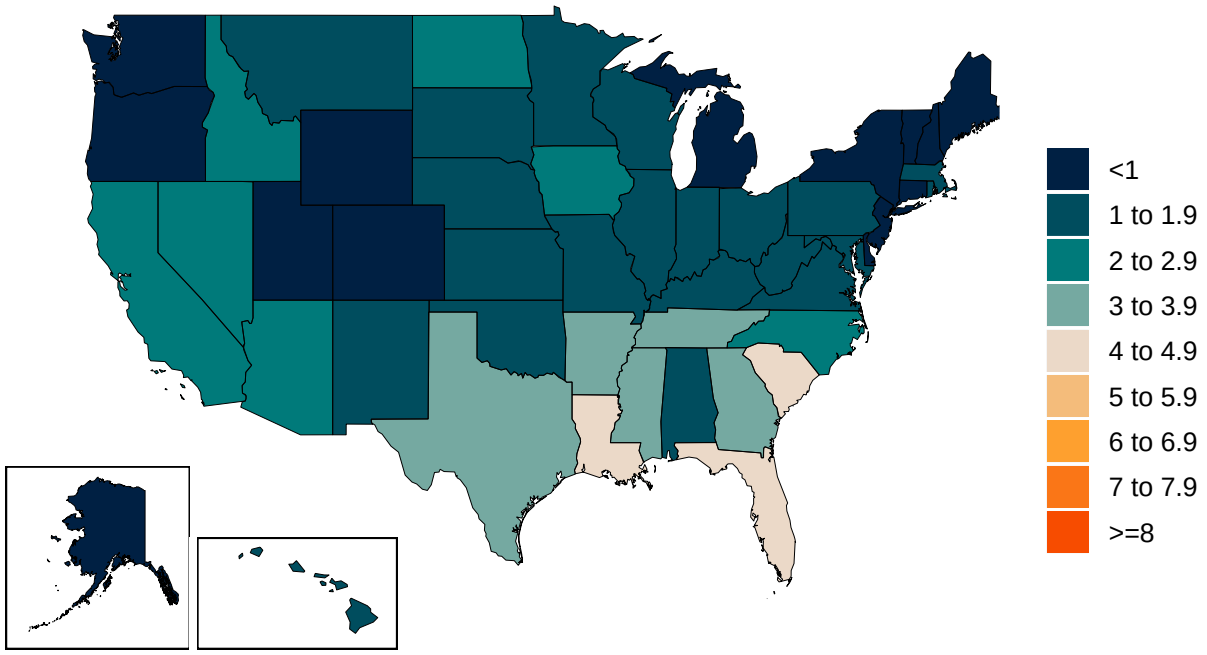


Figure 6. Daily COVID-19 death rate per 1 million on September 14, 2020



Critical drivers

Table 2. Current mandate implementation

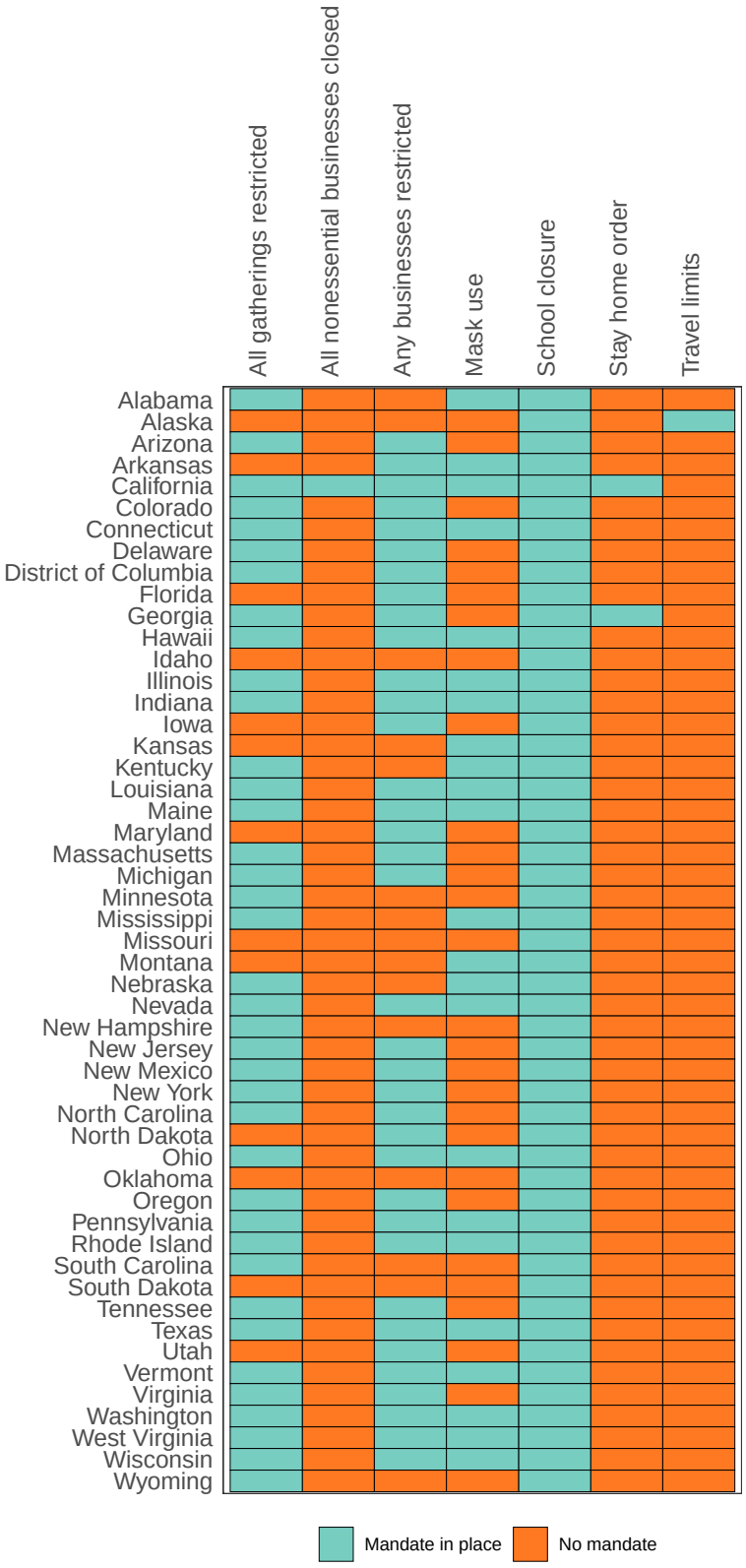


Figure 7. Total number of social distancing mandates (not including mask use)

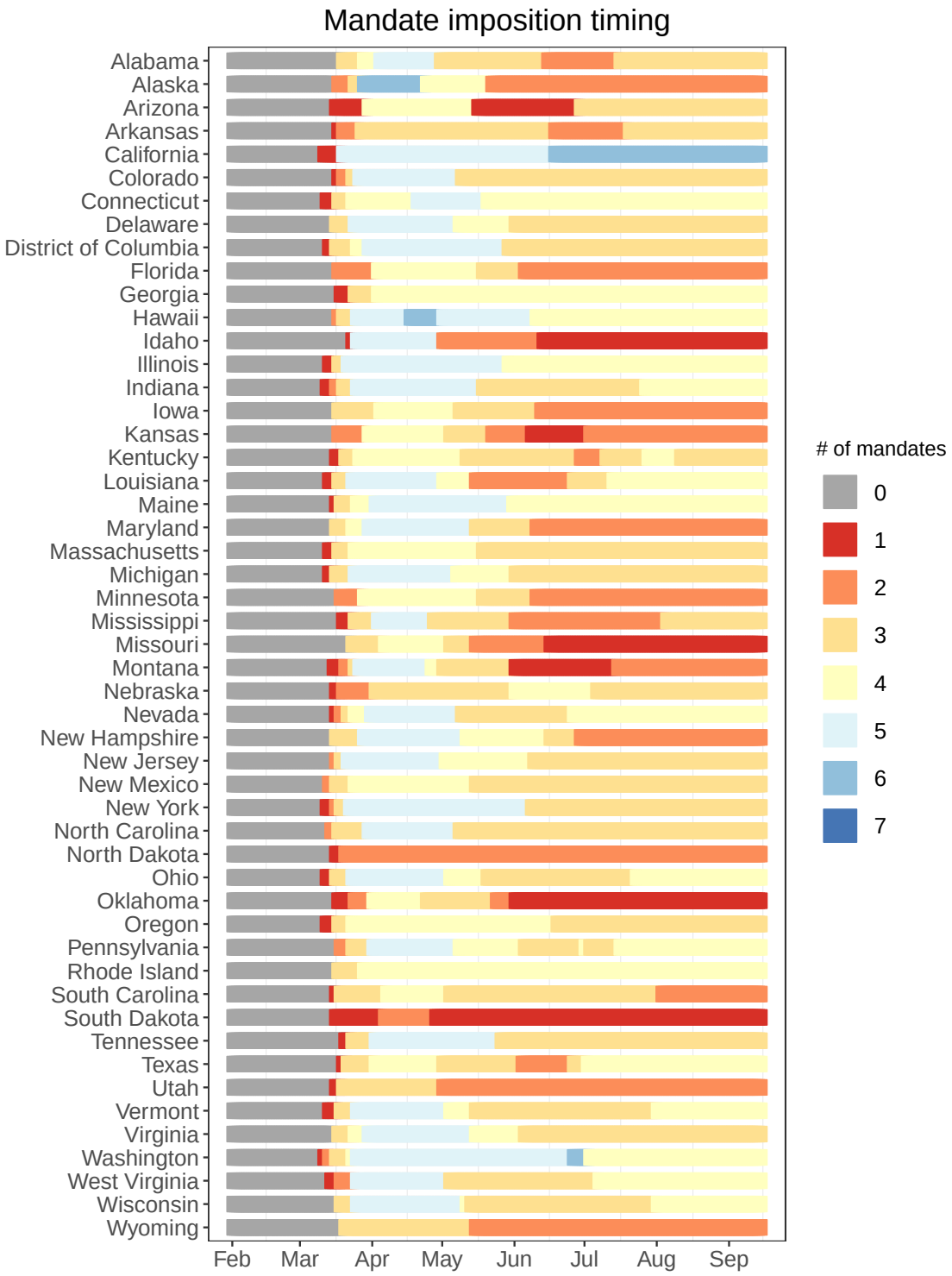


Figure 8a. Trend in mobility as measured through smartphone app use compared to January 2020 baseline

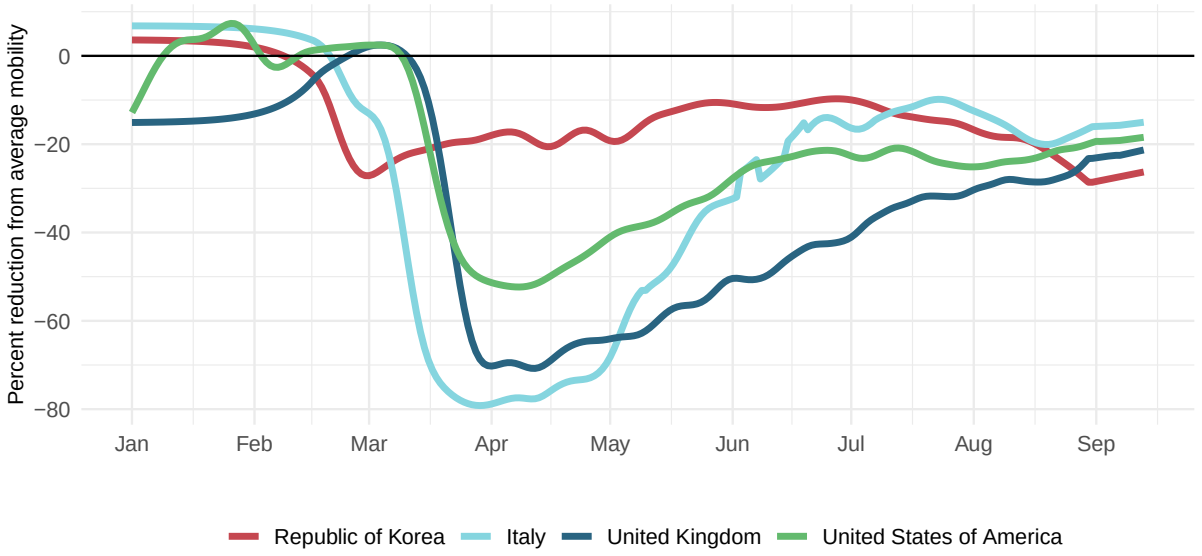


Figure 8b. Mobility level as measured through smartphone app use compared to January 2020 baseline (percent)

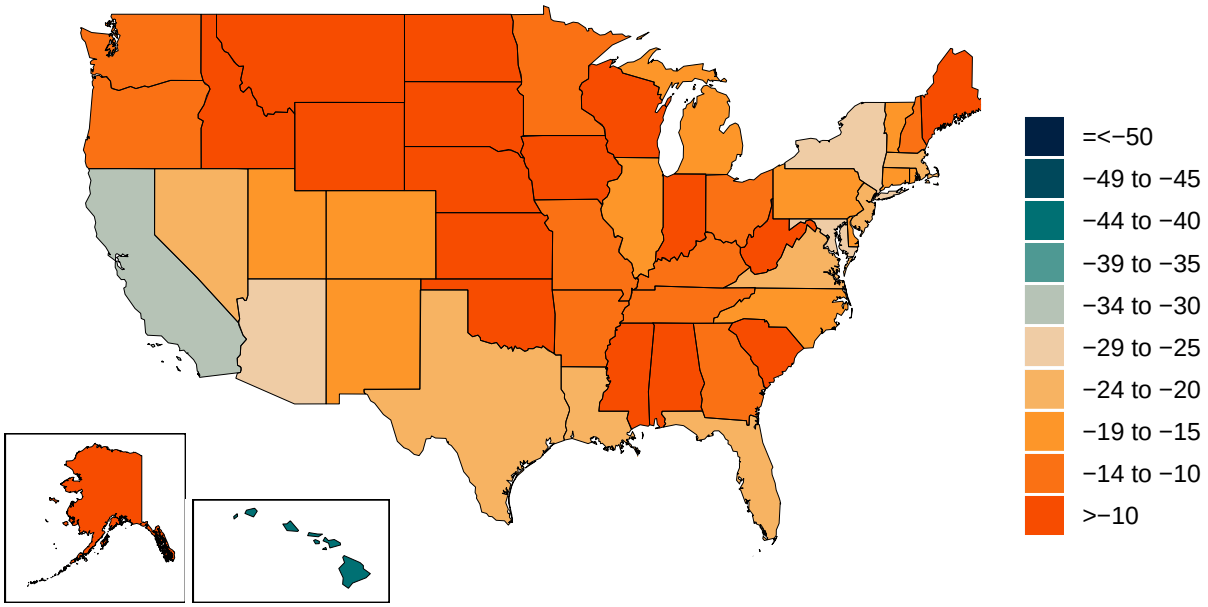


Figure 9a. Trend in the proportion of the population reporting always wearing a mask when leaving home

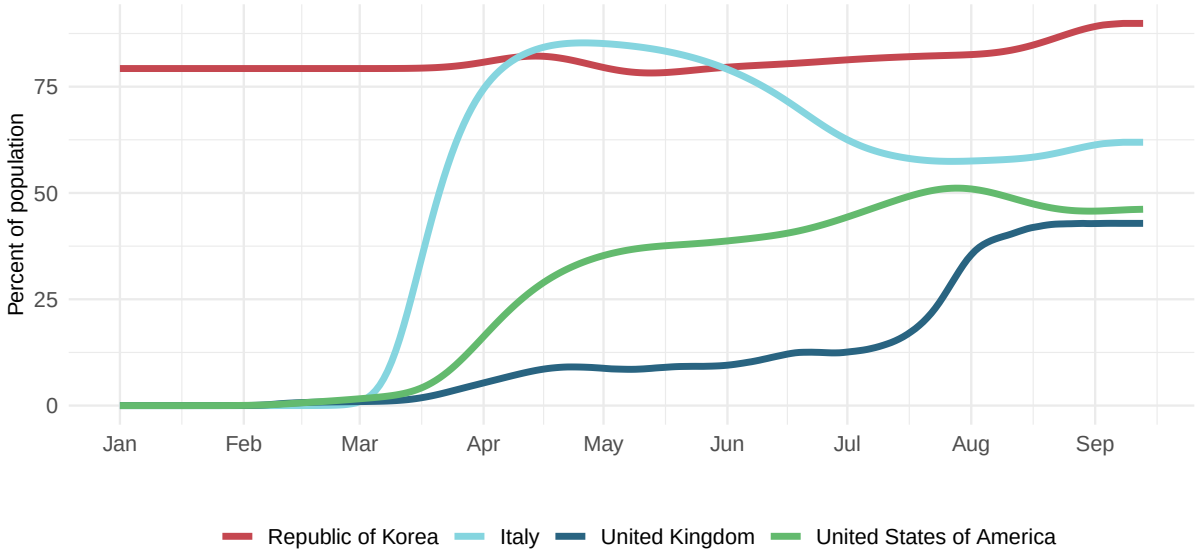


Figure 9b. Proportion of the population reporting always wearing a mask when leaving home on September 14, 2020

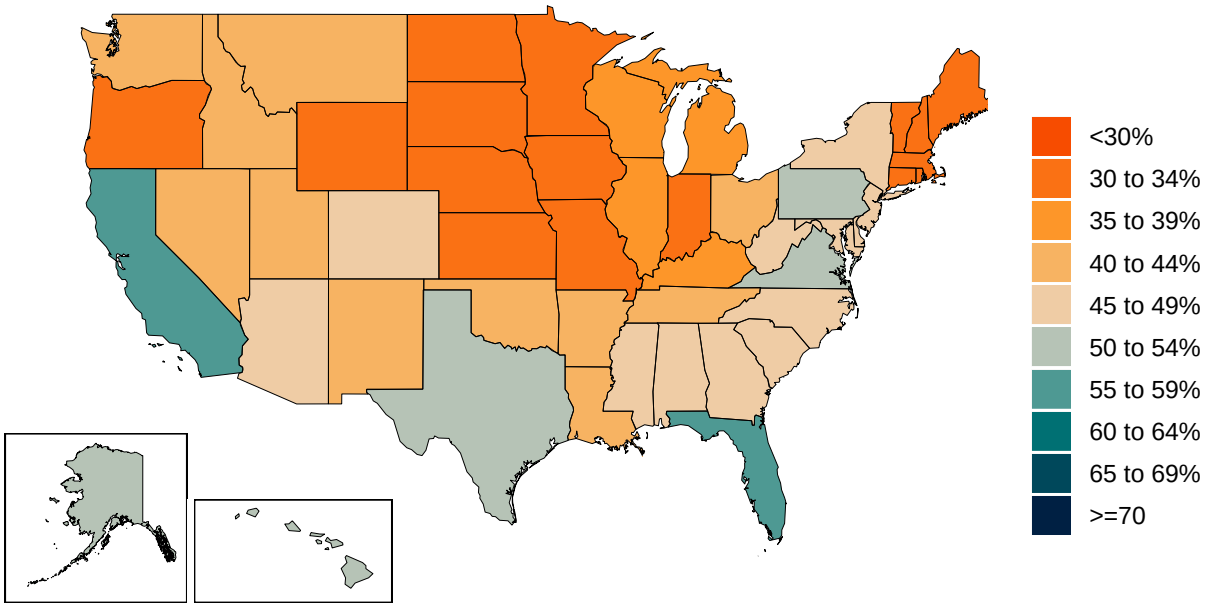


Figure 10a. Trend in COVID-19 diagnostic tests per 100,000 people

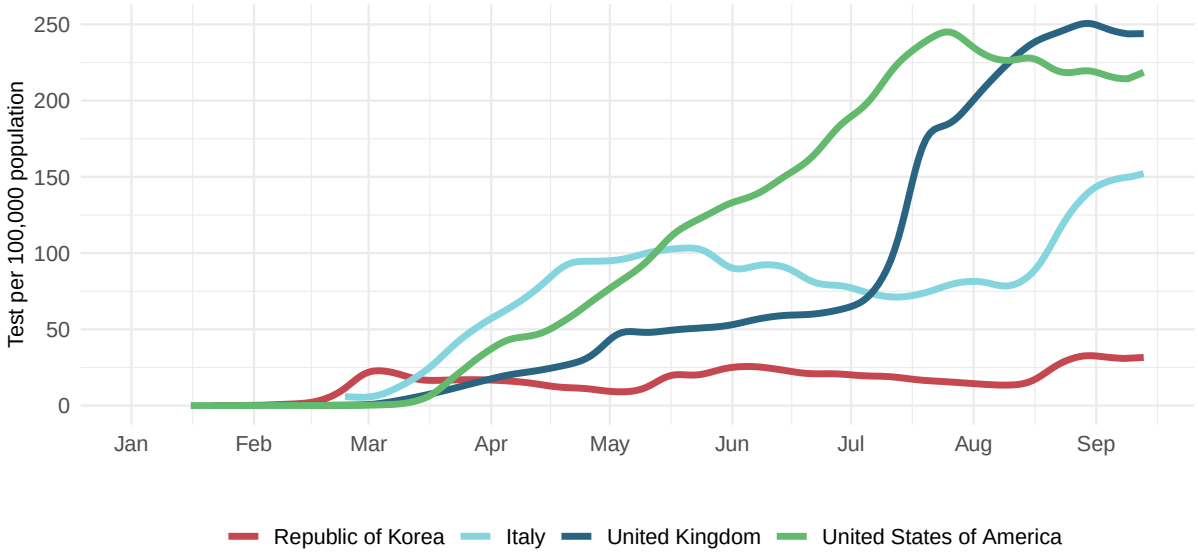


Figure 10b. COVID-19 diagnostic tests per 100,000 people on September 09, 2020

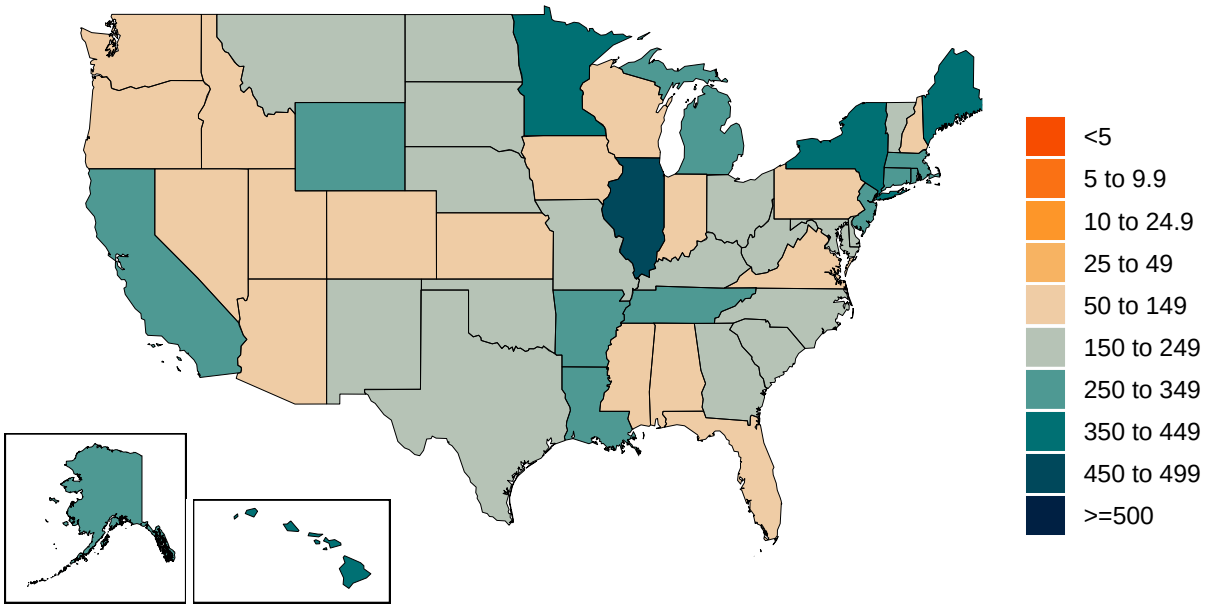
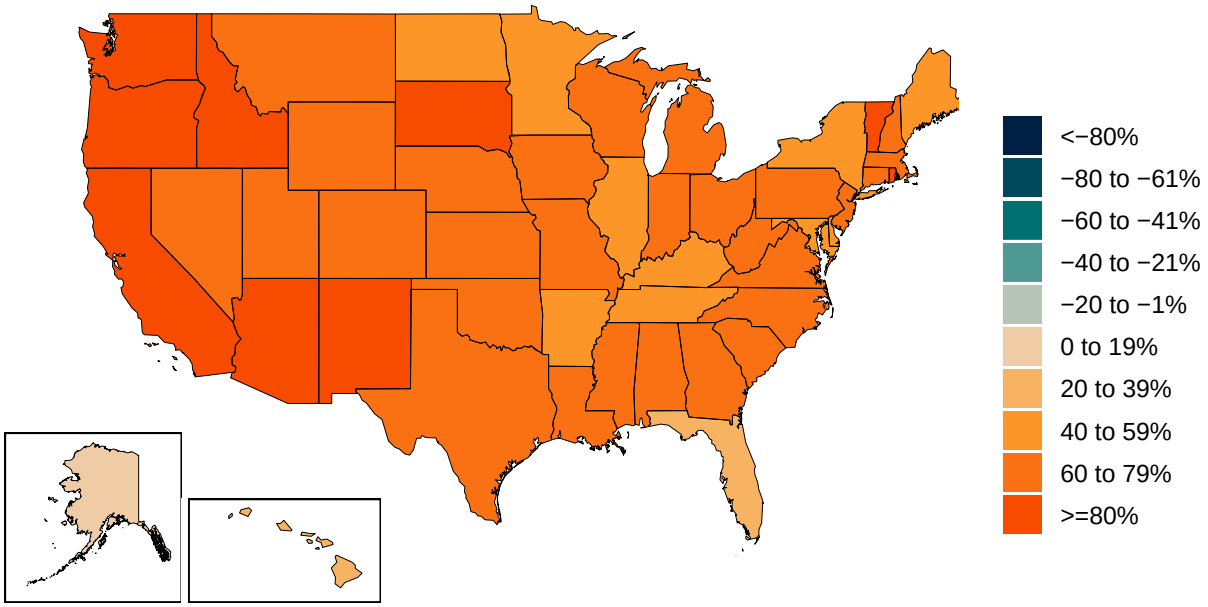


Figure 11. Increase in the risk of death due to pneumonia on February 1 compared to August 1



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. 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.

Figure 12. Cumulative COVID-19 deaths until January 01, 2021 for three scenarios.

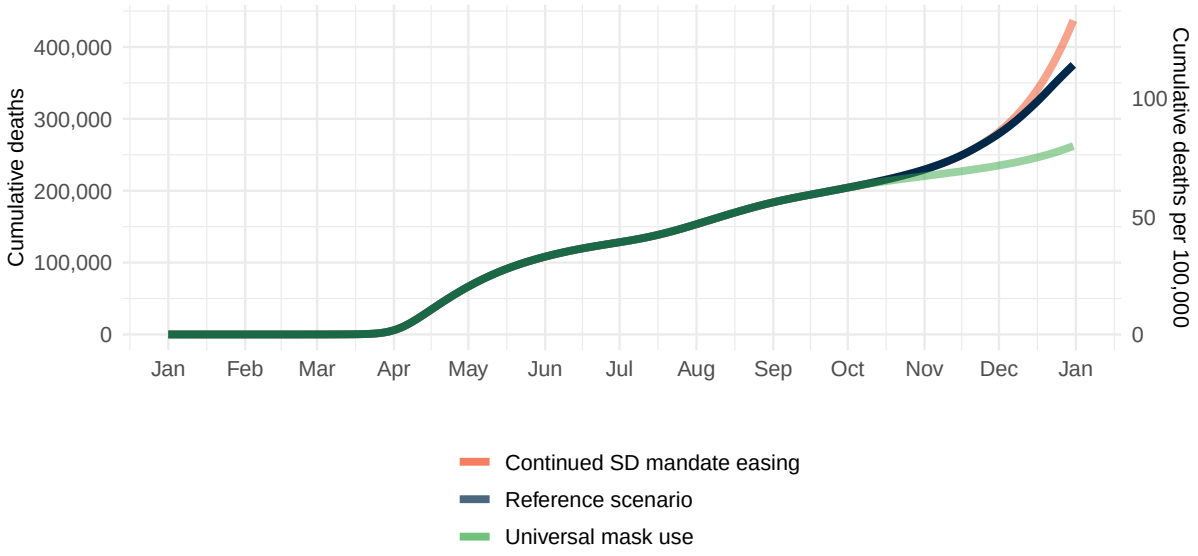


Fig 13. Daily COVID-19 deaths until January 01, 2021 for three scenarios.

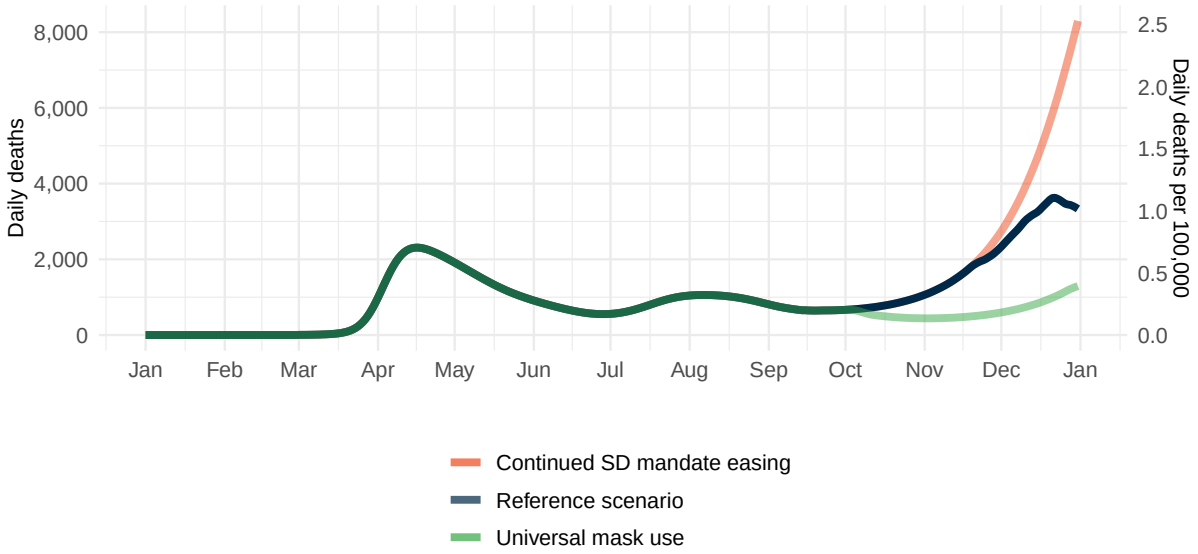


Fig 14. Daily COVID-19 infections until January 01, 2021 for three scenarios.

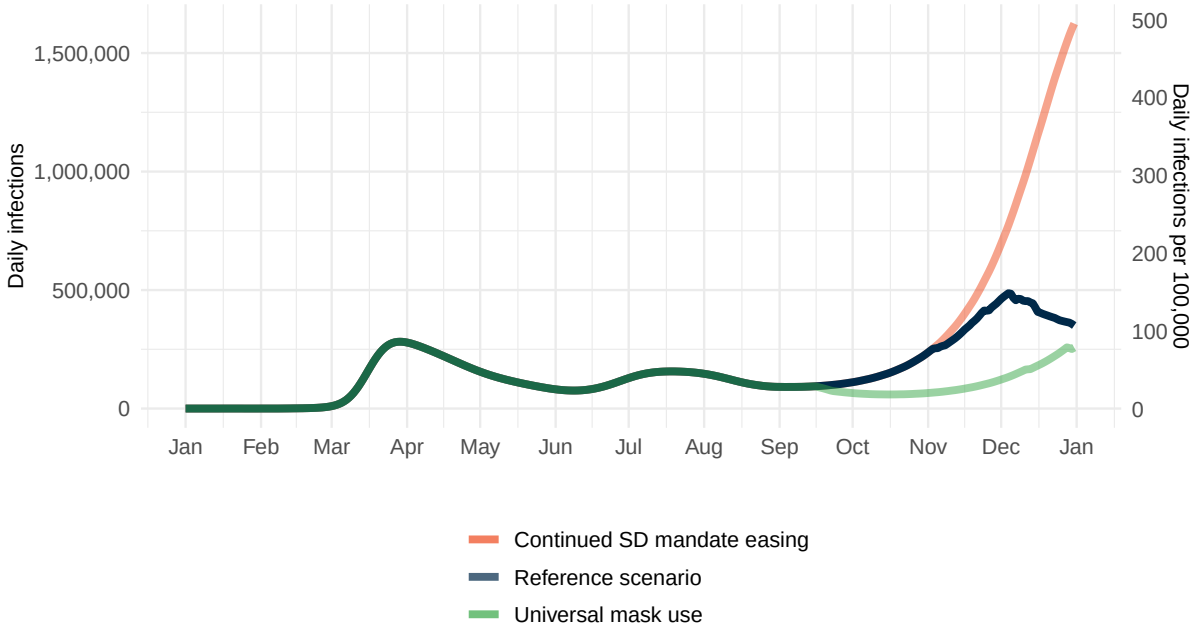


Fig 15. Month of assumed mandate re-implementation. (Month when daily death rate passes 8 per million, when reference scenario model assumes mandates will be re-imposed.)

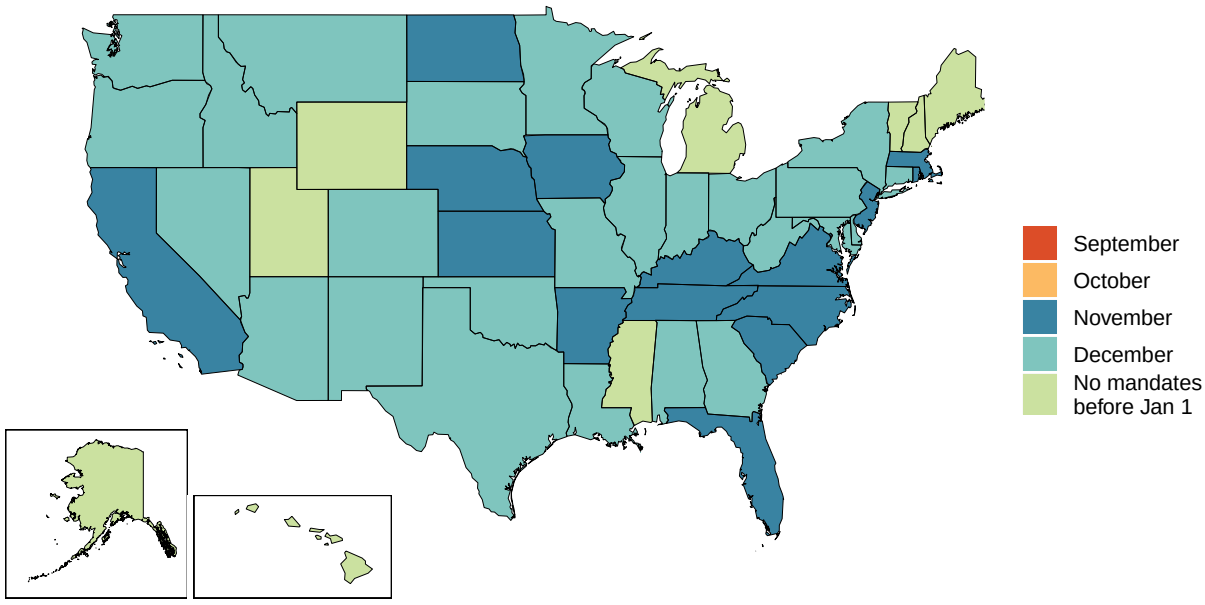


Figure 16. Forecasted percent infected with COVID-19 on January 01, 2021

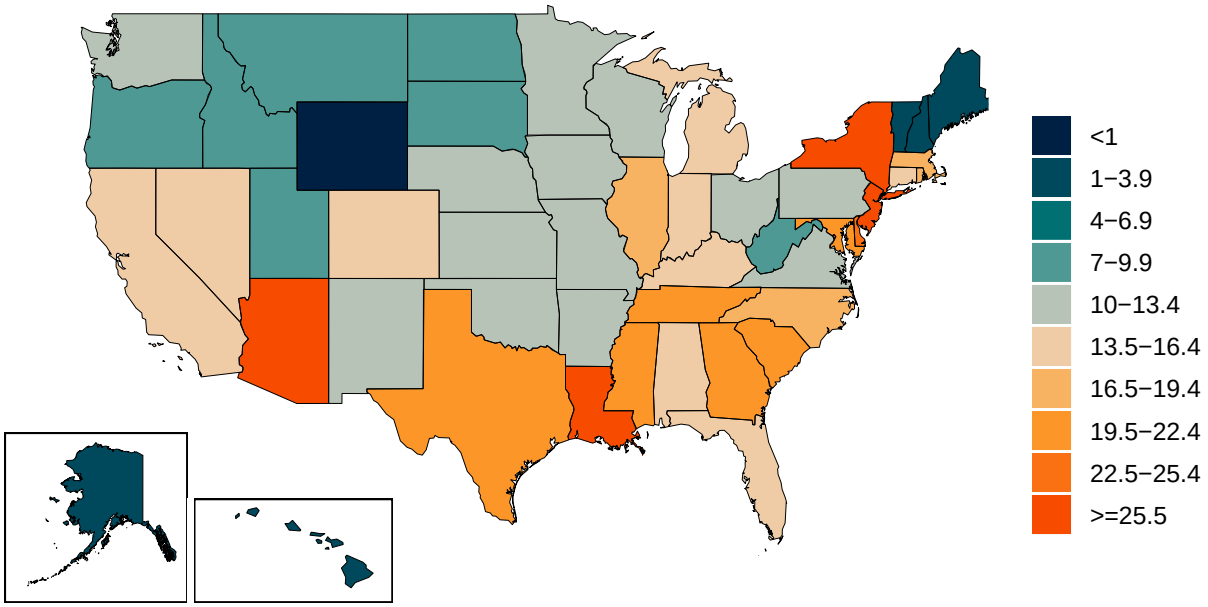


Figure 17. Daily COVID-19 deaths per million forecasted on January 01, 2021 in the reference scenario

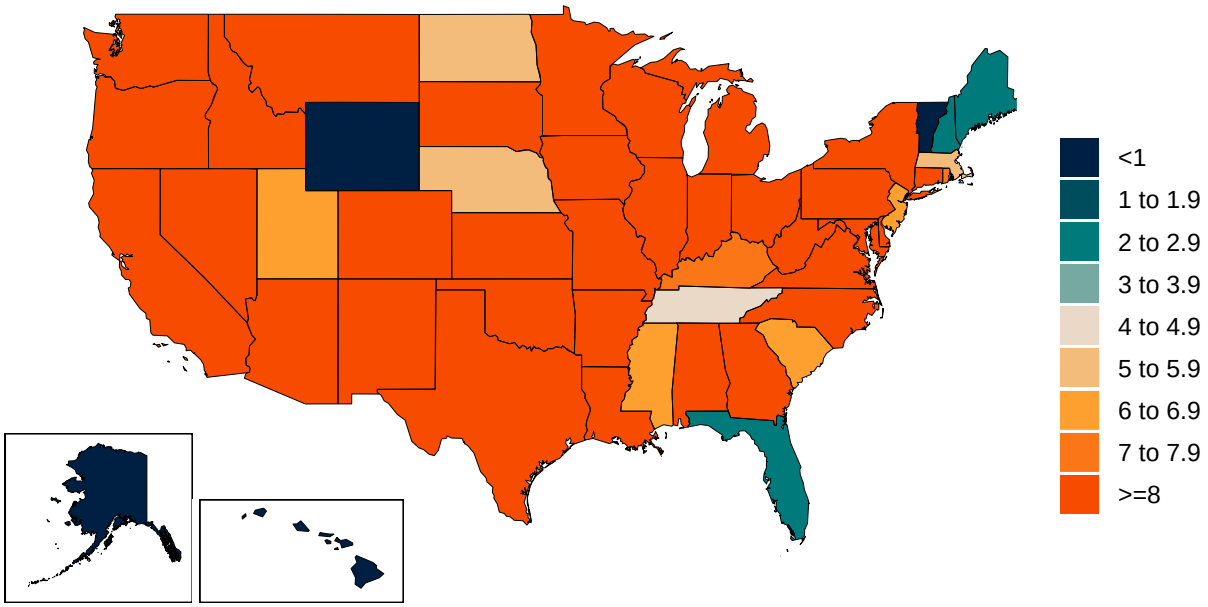


Table 3. Ranking of COVID-19 among the leading causes of mortality in the full year 2020. Deaths from COVID-19 are projections of cumulative deaths on Jan 1, 2021 from the reference scenario. Deaths from other causes are from the Global Burden of Disease study 2019 (rounded to the nearest 100).

Cause name	Annual deaths	Ranking
Ischemic heart disease	557,600	1
COVID-19	378,321	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

Mask data source: Premise; Facebook Global symptom survey (This research is based on survey results from University of Maryland Social Data Science Center); Kaiser Family Foundation; YouGov COVID-19 Behaviour Tracker survey

A note of thanks:

We would like to extend a special thanks to the Pan American Health Organization (PAHO) for key data sources; our partners and collaborators in Argentina, Brazil, Bolivia, Chile, Colombia, Cuba, the Dominican Republic, Ecuador, Egypt, Honduras, Israel, Japan, Malaysia, Mexico, Moldova, Panama, Peru, the Philippines, Russia, Serbia, South Korea, Turkey, and Ukraine for their support and expert advice; and to the tireless data collection and collation efforts of individuals and institutions throughout the world.

In addition, we wish to express our gratitude for efforts to collect social distancing policy information in Latin America to University of Miami Institute for Advanced Study of the Americas (Felicia Knaul, Michael Touchton), with data published here: http://observcovid.miami.edu/; Fundación Mexicana para la Salud (Héctor Arreola-Ornelas) with support from the GDS Services International: Tómatelo a Pecho A.C.; and Centro de Investigaciones en Ciencias de la Salud, Universidad Anáhuac (Héctor Arreola-Ornelas); Lab on Research, Ethics, Aging and Community-Health at Tufts University (REACH Lab) and the University of Miami Institute for Advanced Study of the Americas (Thalia Porteny).

Further, IHME is grateful to the Microsoft AI for Health program for their support in hosting our COVID-19 data visualizations on the Azure Cloud. We would like to also extend a warm thank you to the many others who have made our COVID-19 estimation efforts possible.