COVID-19 Results Briefing

Global

March 24, 2021

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

The global epidemic, measured through cases and deaths, is increasing. The most concerning trend is the P1-driven epidemic in Brazil. Given that P1 is an escape variant and seasonality is intensifying in the Southern Hemisphere, this epidemic could have the largest impact on deaths. The B.1.1.7-driven surge in Europe continues despite extensive social distancing mandates in place. B.1.1.7 is starting to have an impact in the United States, best illustrated by the upturn in Michigan. The recent increases in South Asia, including Bangladesh and Punjab state in India, are also very concerning. While the root cause in South Asia is less clear, it seems likely this is due to one of the escape variants or a novel variant. Finally, the upswing in Turkey may suggest that one of the other variants is also associated with increased transmission. While vaccine rollout continues, media coverage of AstraZeneca side effects may account for the decline in vaccine confidence seen in a number of countries. Supply issues also mean that our projected number of adults vaccinated has been revised downward. The main strategies for countries to use must focus on accelerated vaccine rollout wherever this is possible, sustained mask use through mandates and social messaging, and the use of social distancing mandates as needed. Social unrest in a number of countries against mandates indicates that this approach may become more challenging in the coming weeks and months.

Current situation

- Daily reported cases in the last week increased to 459,700 per day on average compared to 407,500 the week before (Figure 1). This represents a 13% increase in one week.
- Daily deaths in the last week increased to 10,300 per day on average compared to 10,000 the week before (Figure 2), a 3% increase in one week. COVID-19 is the number 3 cause of death globally this week (Table 1).
- The daily death rate is greater than 4 per million in 29 countries (Figure 3). High death rates are mostly concentrated in two zones: South America and Europe.
- We estimated that 11% of people globally have been infected as of March 22 (Figure 4).
- Effective R, computed using cases, hospitalizations, and deaths, is greater than 1 in countries in South America, North America, sub-Saharan Africa, the Middle East and South Asia (Figure 5).
- The global infection-detection rate is close to 20% (Figure 6).

- Variants of concern have three distinct geographic patterns (Figure 7). B.1.1.7 is circulating widely in Europe and now increasingly in the United States. B.1.351 is the dominant variant in Southern Africa. And P1 is the dominant variant in northern Brazil, Peru, Colombia, and Venezuela.
- The infection-detection rate is highest in the Russian Federation, Ohio, and Rio Grande do Sul in Brazil (Figure 8).

Trends in drivers of transmission

- Mobility last week was 18% lower than the pre-COVID-19 baseline (Figure 9). Mobility was near baseline (within 10%) in 49 countries. Mobility was lower than 30% of baseline in in 44 countries.
- As of March 22, we estimated that 62% of people always wore a mask when leaving their home (Figure 11). Mask use was lower than 50% in in 45 countries.
- There were 122 diagnostic tests per 100,000 people on March 22 (Figure 13).
- Globally, 72% 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 35% in the Democratic Republic of the Congo to 93% in Asturias in Spain (Figure 16). There has been a reduction in vaccine confidence over the last week. The lowest levels of vaccine confidence are in Eastern Europe, the Middle East, and sub-Saharan Africa.
- In our current reference scenario, we expect that 2.9 billion will be vaccinated by July 1 (Figure 17).

Projections

- In our **reference scenario**, which represents what we think is most likely to happen, our model projects 3,990,000 cumulative deaths on July 1, 2021. This represents 808,000 additional deaths from March 22 to July 1 (Figure 18). Daily deaths are expected to peak in mid-April (Figure 19).
- If **universal mask coverage (95%)** were attained in the next week, our model projects 165,000 fewer cumulative deaths compared to the reference scenario on July 1, 2021 (Figure 18).
- Under our **worse scenario**, which has faster reductions in mask use and increases in mobility, our model projects 4,251,000 cumulative deaths on July 1, 2021 (Figure 18). This represents 261,000 more deaths than in the reference scenario. Daily deaths remain over 9,000 all the way through to July 1.
- By July 1, we project that 221,200 lives will be saved by the projected vaccine rollout. This does not include lives saved through vaccination that has already taken place.
- Daily infections in the reference scenario decline to a low of 1.5 million in early May and then increase. In the worse scenario, daily infections steadily increase from mid-April onward, reaching to nearly 5 million by July 1.

- Figure 21 compares our reference scenario forecasts to other publicly archived models. Forecasts are widely divergent.
- At some point from March through July 1, 86 countries will have high or extreme stress on hospital beds (Figure 22). At some point from March through July 1, 96 countries will have high or extreme stress on ICU capacity (Figure 23).

Model updates

Variant spread

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.

Current situation

Figure 1. Reported daily COVID-19 cases

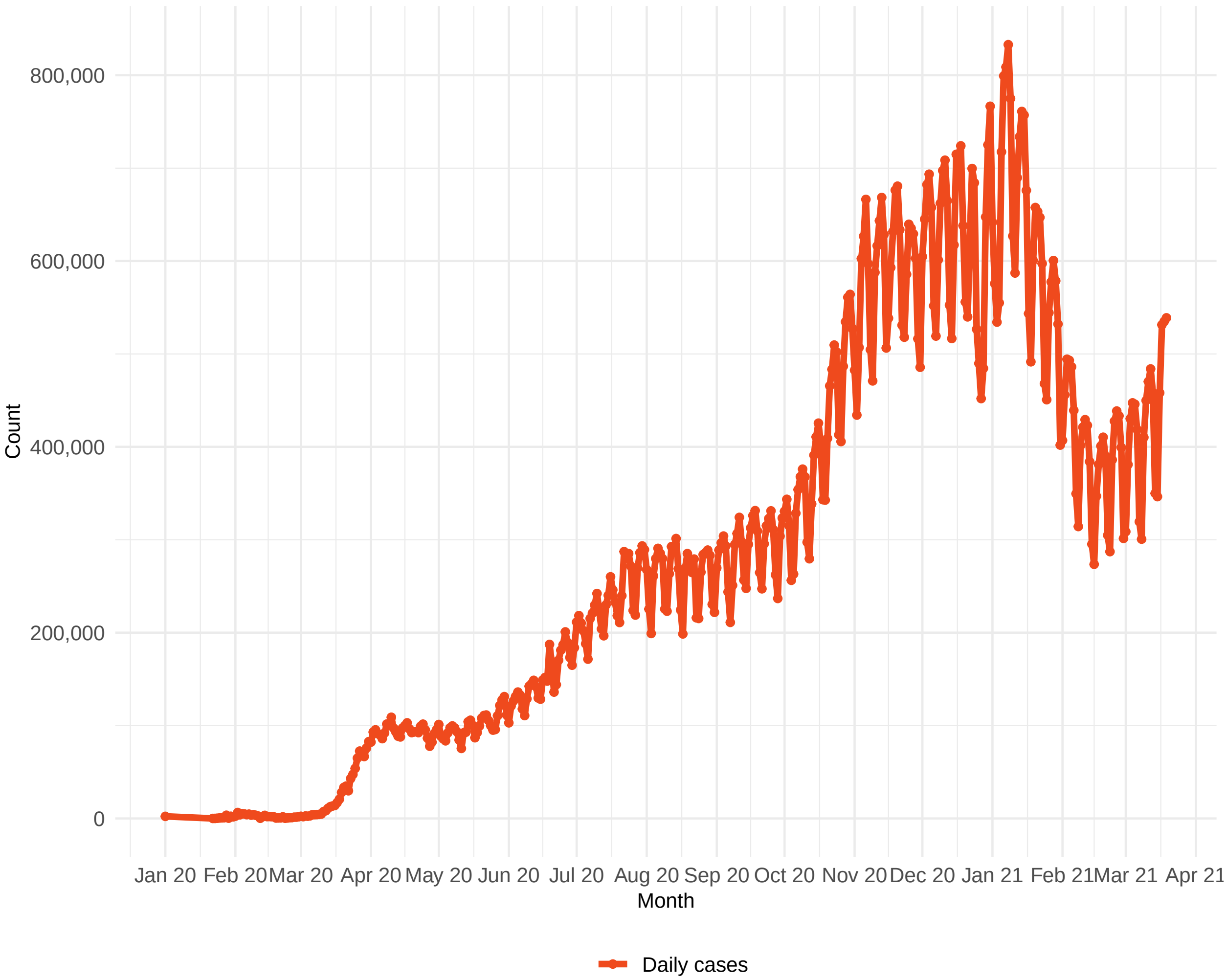


Table 1. Ranking of COVID-19 among the leading causes of mortality this week, assuming uniform deaths of non-COVID causes throughout the year

Cause name	Weekly deaths	Ranking
Ischemic heart disease	175,727	1
Stroke	126,014	2
COVID-19	71,836	3
Chronic obstructive pulmonary disease	63,089	4
Lower respiratory infections	47,946	5
Tracheal, bronchus, and lung cancer	39,282	6
Neonatal disorders	36,201	7
Alzheimer's disease and other dementias	31,217	8
Diabetes mellitus	29,830	9
Diarrheal diseases	29,509	10

Figure 2. Reported daily COVID-19 deaths and smoothed trend estimate.

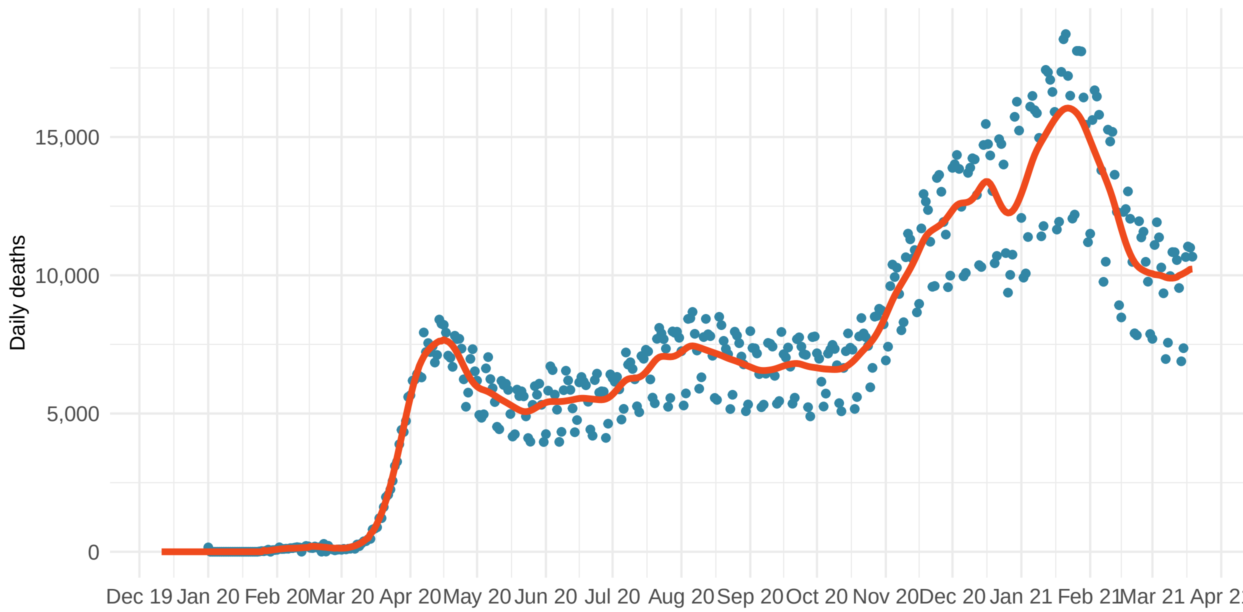


Figure 3. Daily COVID-19 death rate per 1 million on March 22, 2021

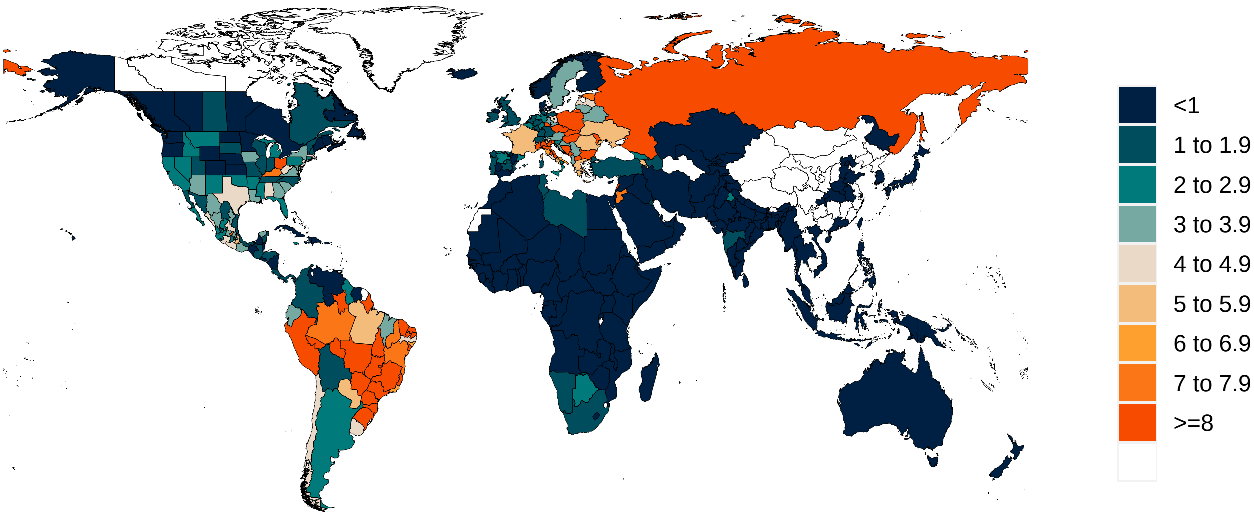


Figure 4. Estimated percent infected with COVID-19 on March 22, 2021

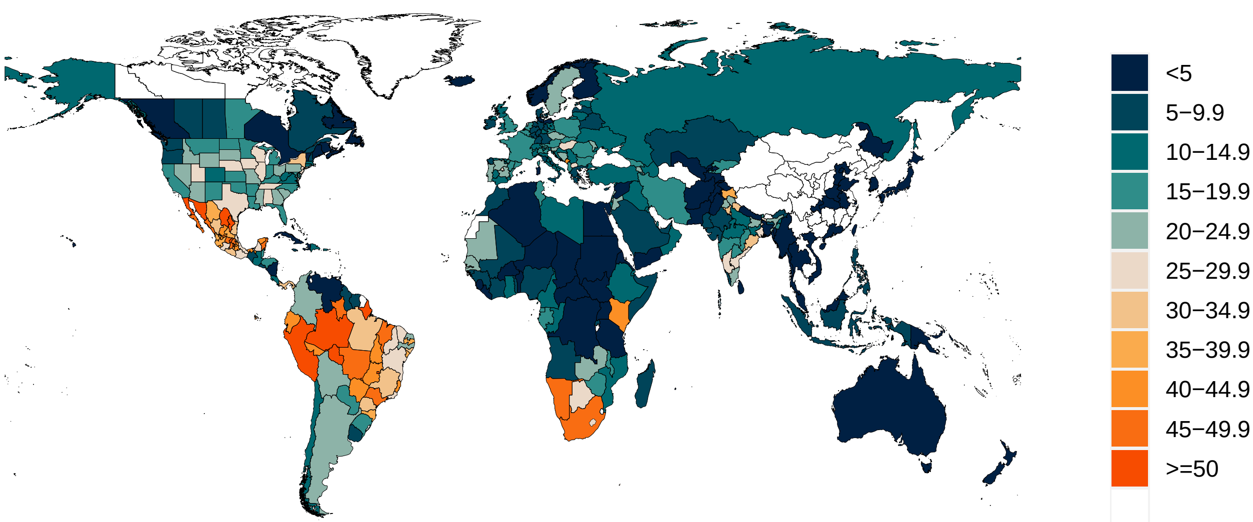


Figure 5. Mean effective R on March 11, 2021. The estimate of effective R is based on the combined analysis of deaths, case reporting and hospitalizations where available. Current reported cases reflect infections 11-13 days prior so estimates of effective R can only be made for the recent past. Effective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

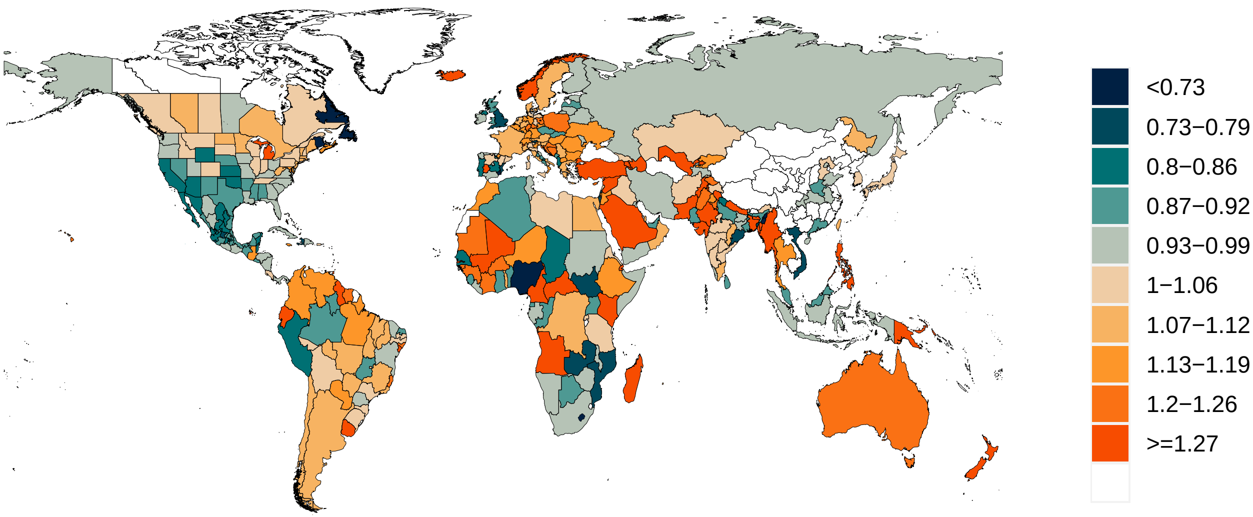
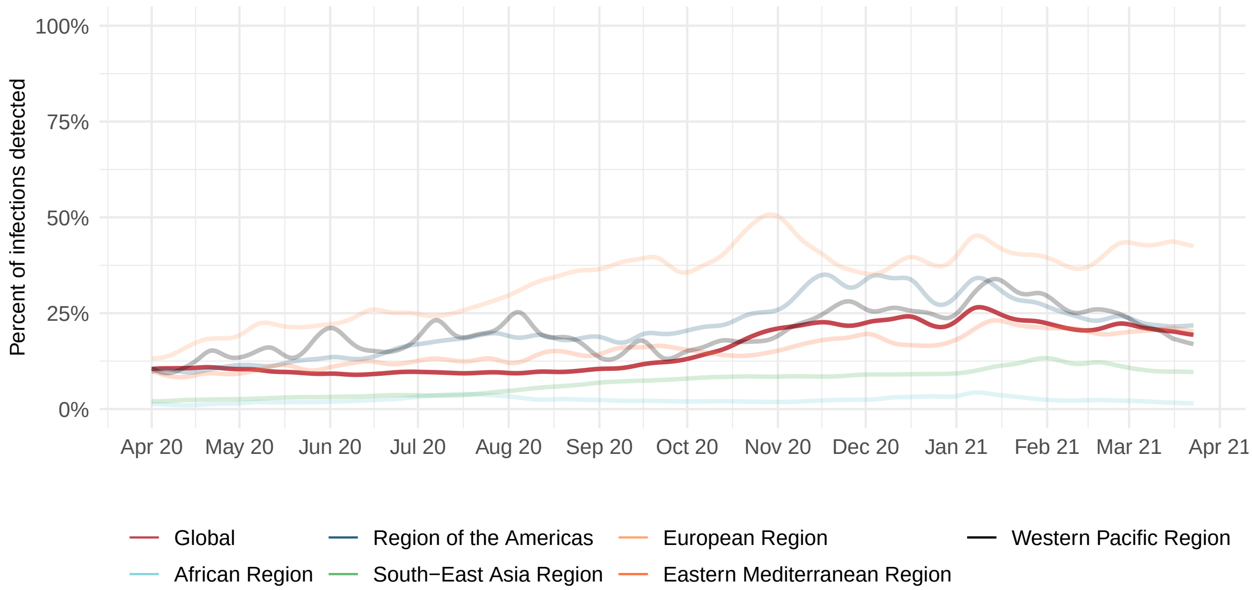


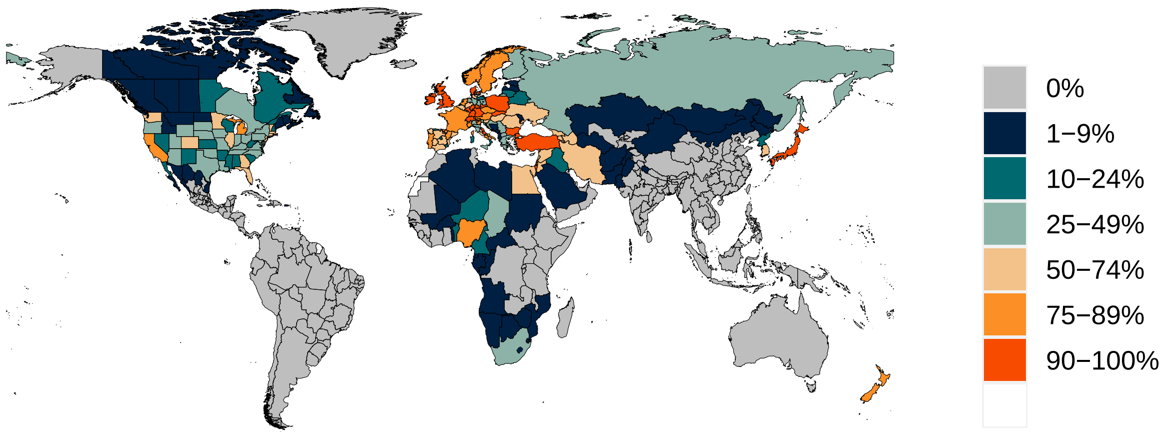
Figure 6. Percent of COVID-19 infections detected. This is estimated as the ratio of reported daily COVID-19 cases to estimated daily COVID-19 infections based on the SEIR disease transmission model.



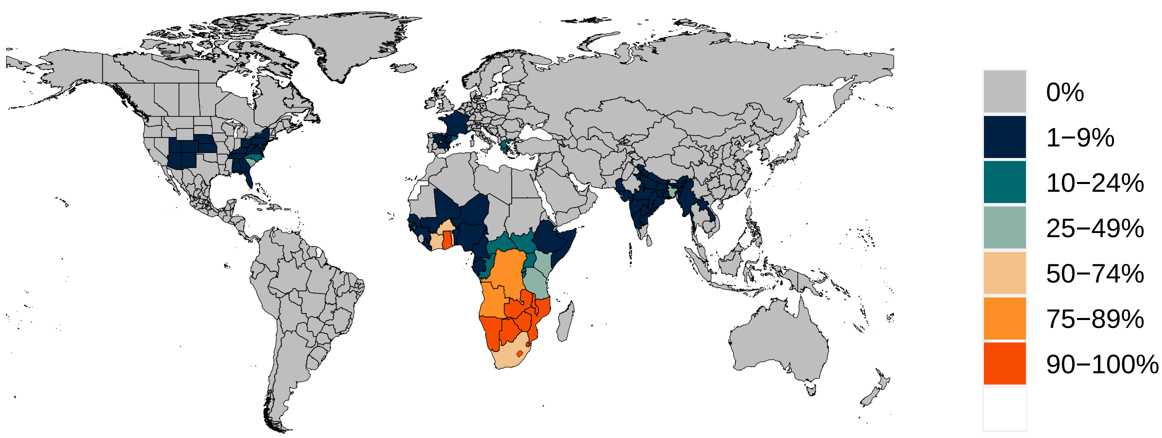
*Due to measurement errors in cases and testing rates, the infection to detection rate (IDR) can exceed 100% at particular points in time.

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

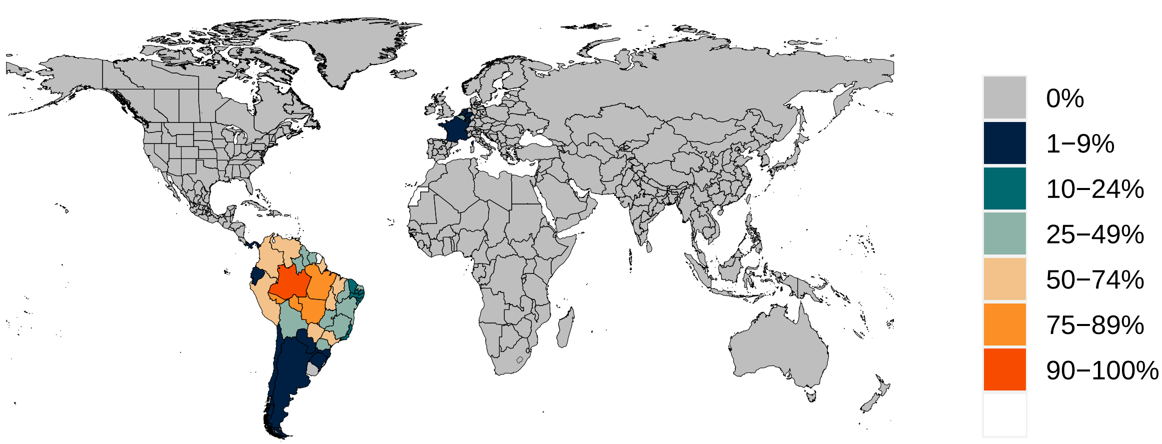
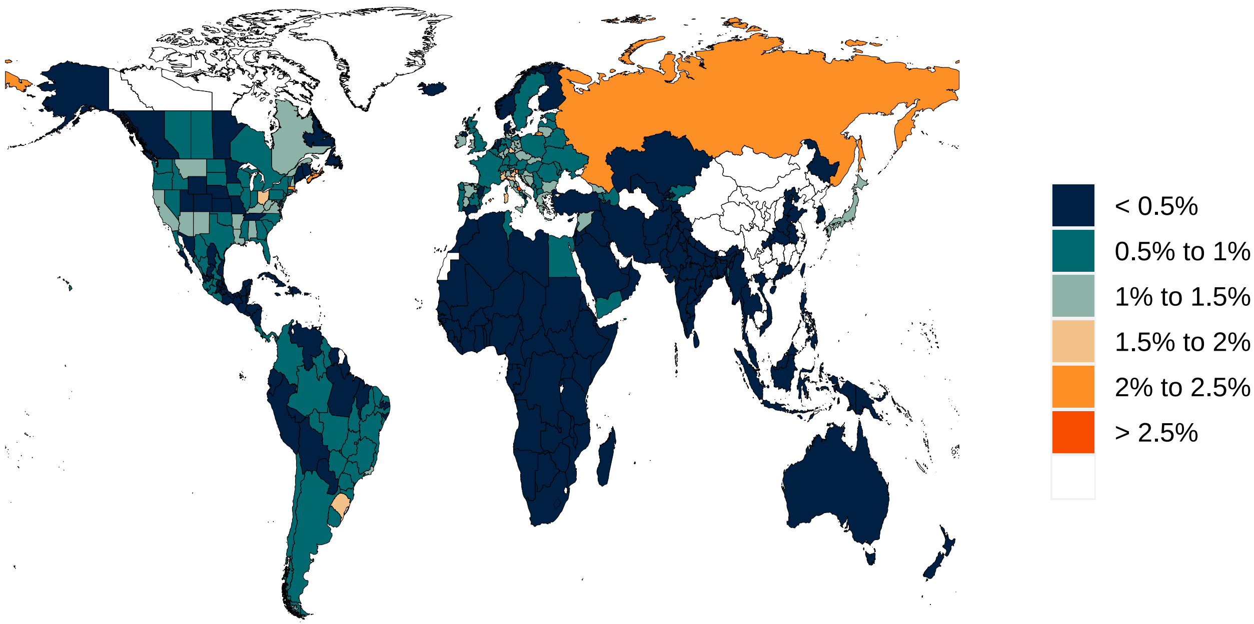


Figure 8. Infection fatality ratio on March 22, 2021. This is estimated as the ratio of COVID-19 deaths to infections based on the SEIR disease transmission model.



Critical drivers

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

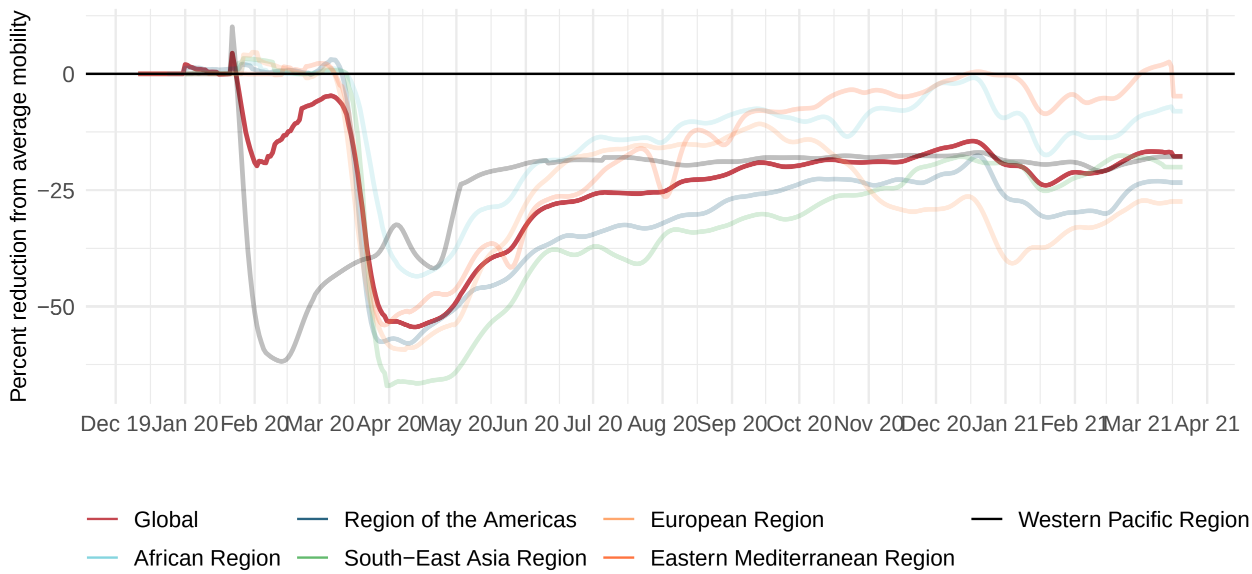


Figure 10. Mobility level as measured through smartphone app use compared to January 2020 baseline (percent)

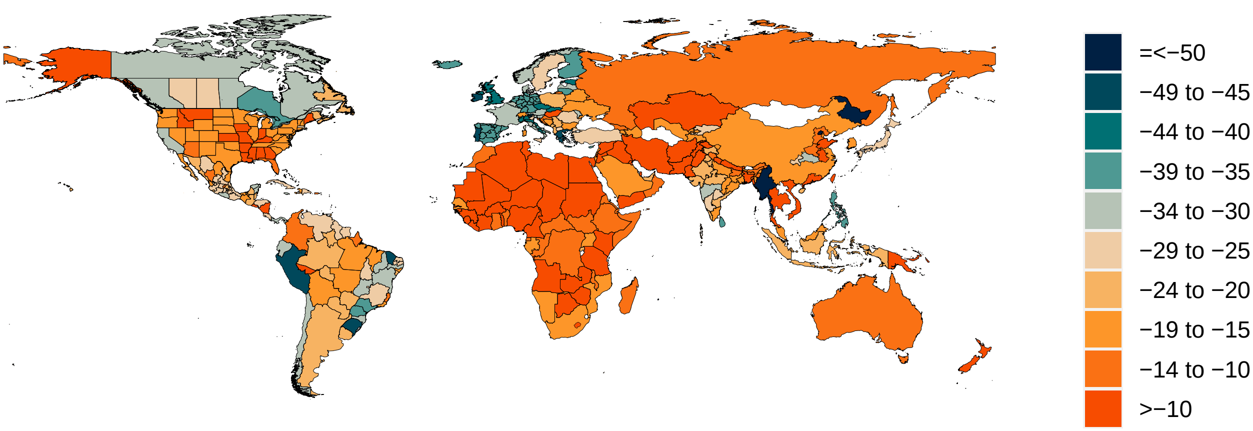


Figure 11. Trend in the proportion of the population reporting always wearing a mask when leaving home

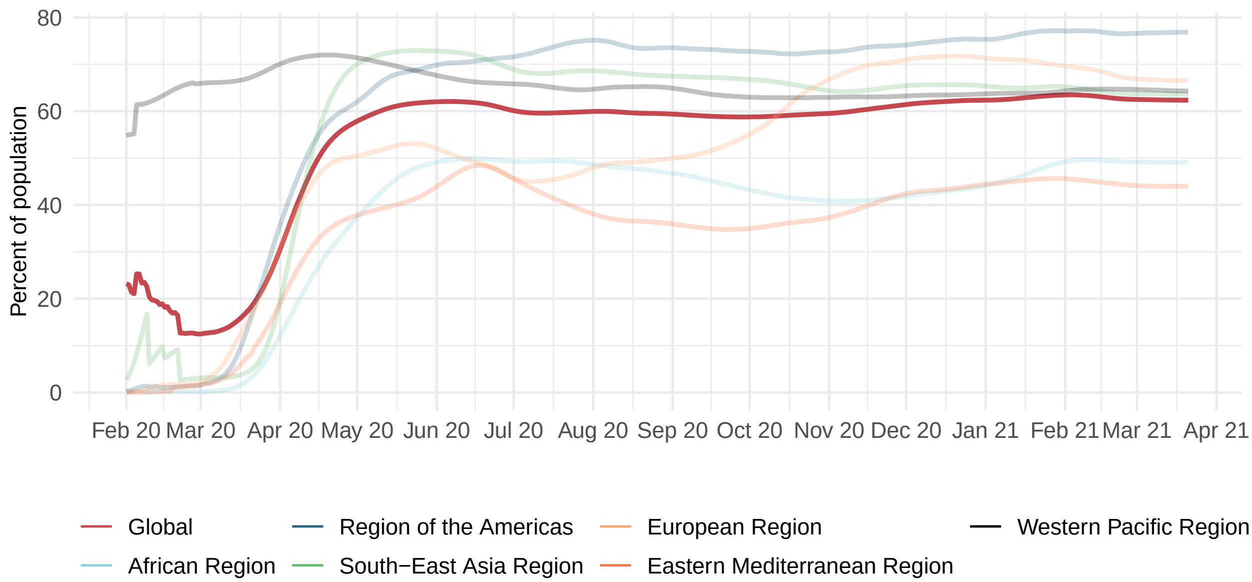


Figure 12. Proportion of the population reporting always wearing a mask when leaving home on March 22, 2021

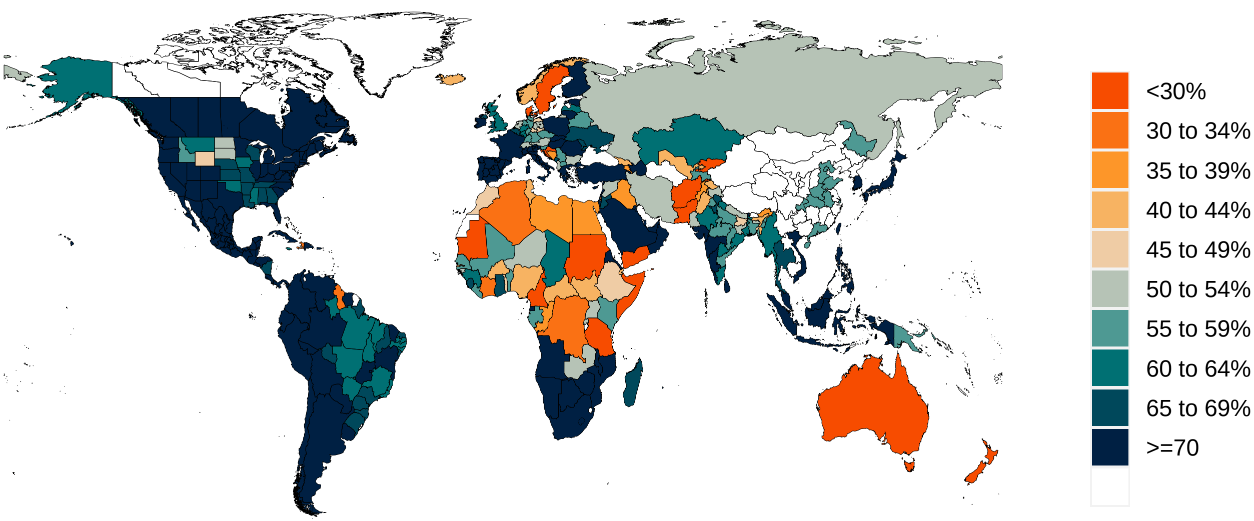


Figure 13. Trend in COVID-19 diagnostic tests per 100,000 people

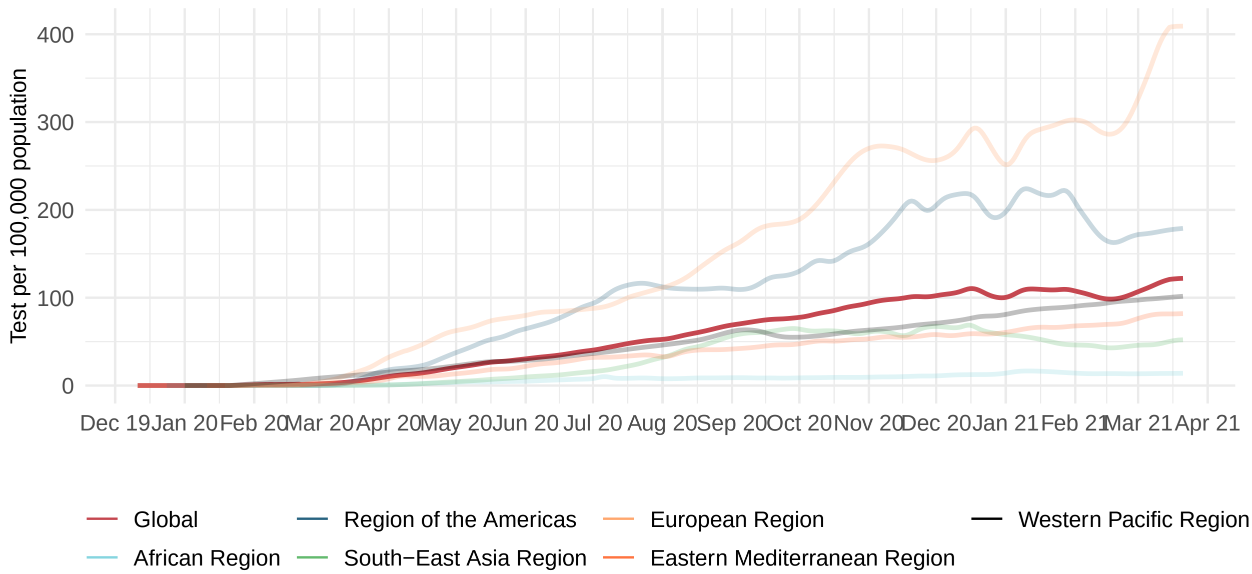


Figure 14. COVID-19 diagnostic tests per 100,000 people on March 21, 2021

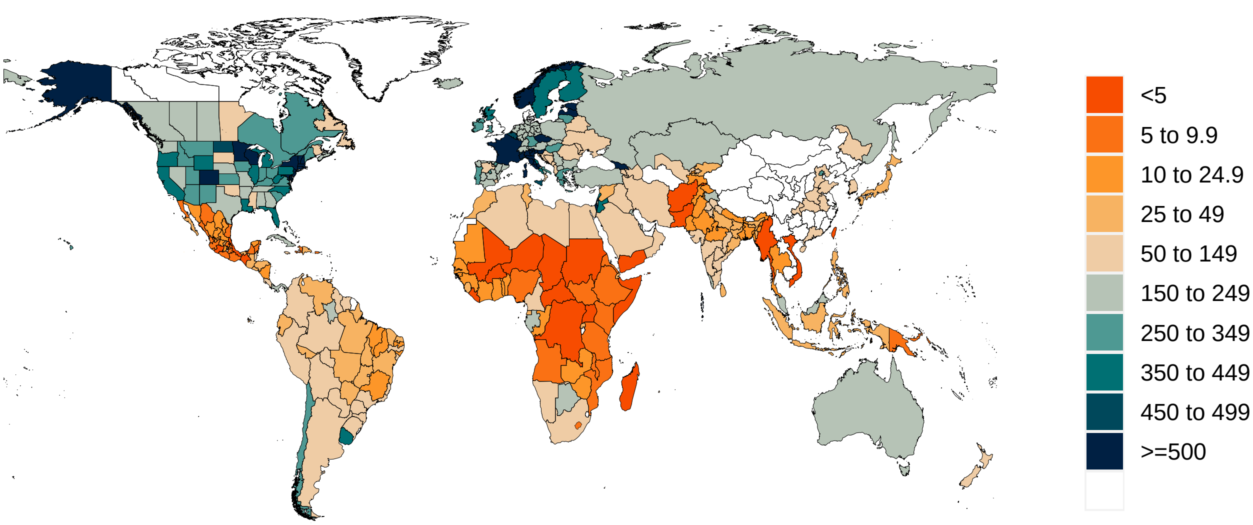


Figure 15. Increase in the risk of death due to pneumonia on February 1 2020 compared to August 1 2020

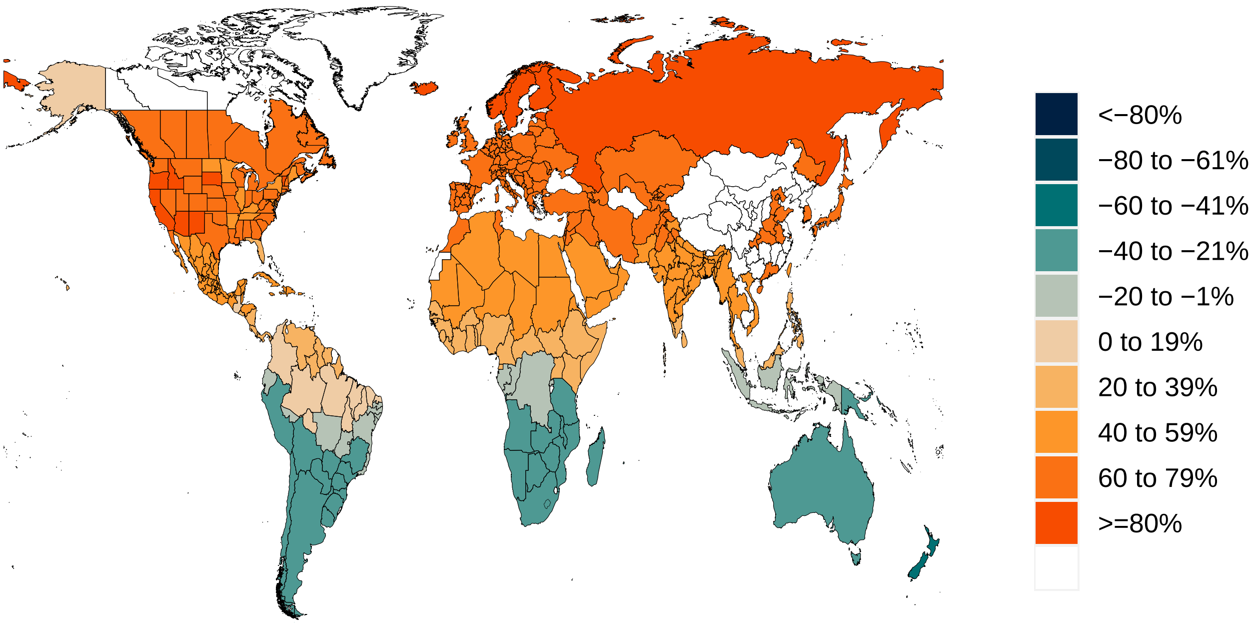


Table 3. The SEIR model uses variant-specific estimates of vaccine efficacy at preventing symptomatic disease and at preventing infection. We use data from clinical trials directly, where available, and make estimates otherwise. More information can be found on our website (http://www.healthdata.org/node/8584).

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).

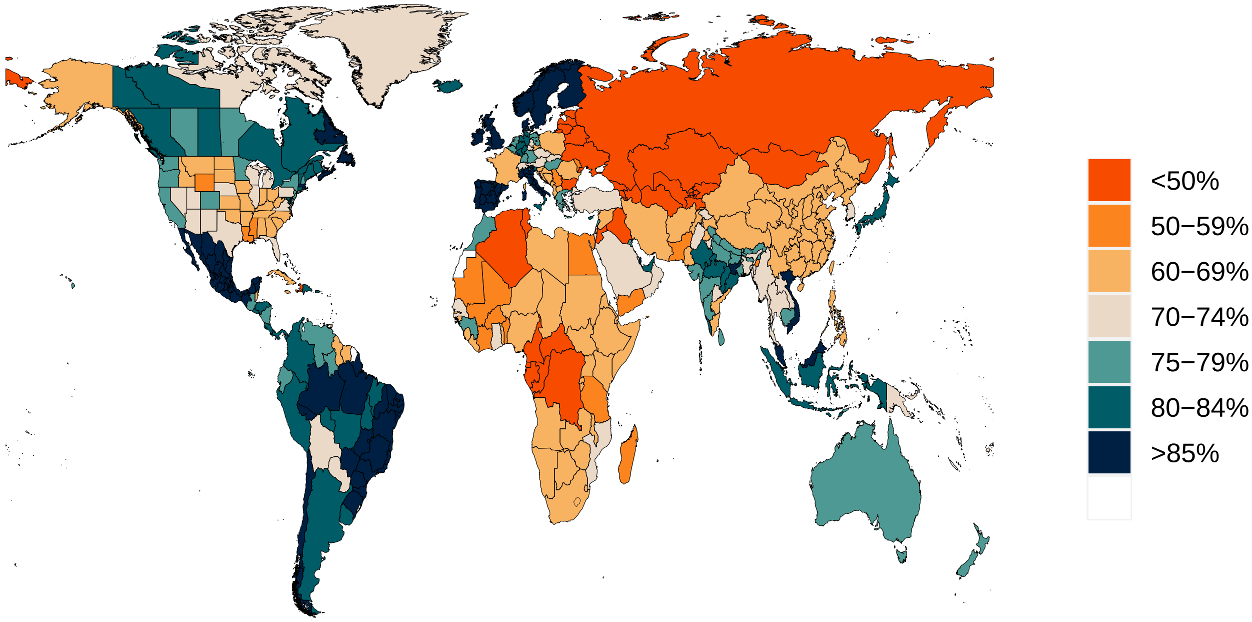
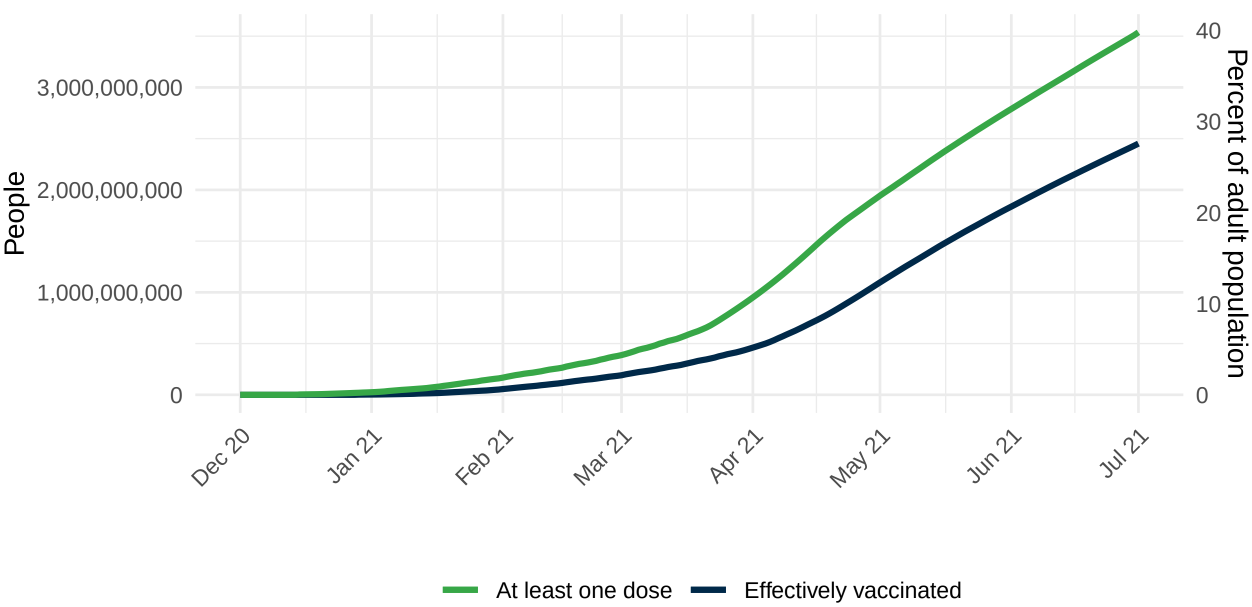


Figure 17. The number of people who receive any vaccine and those who are effectively vaccinated and protected against disease, accounting for efficacy, loss to follow up for two-dose vaccines, partial immunity after one dose, and immunity after two doses.



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.

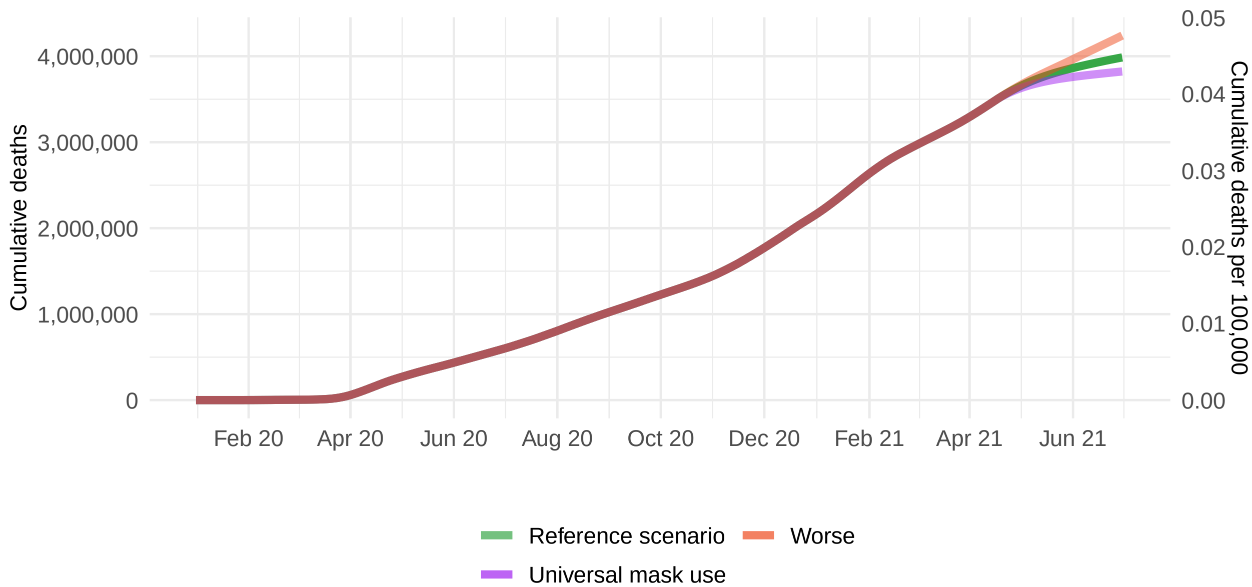


Figure 19. Daily COVID-19 deaths until July 01, 2021 for three scenarios,

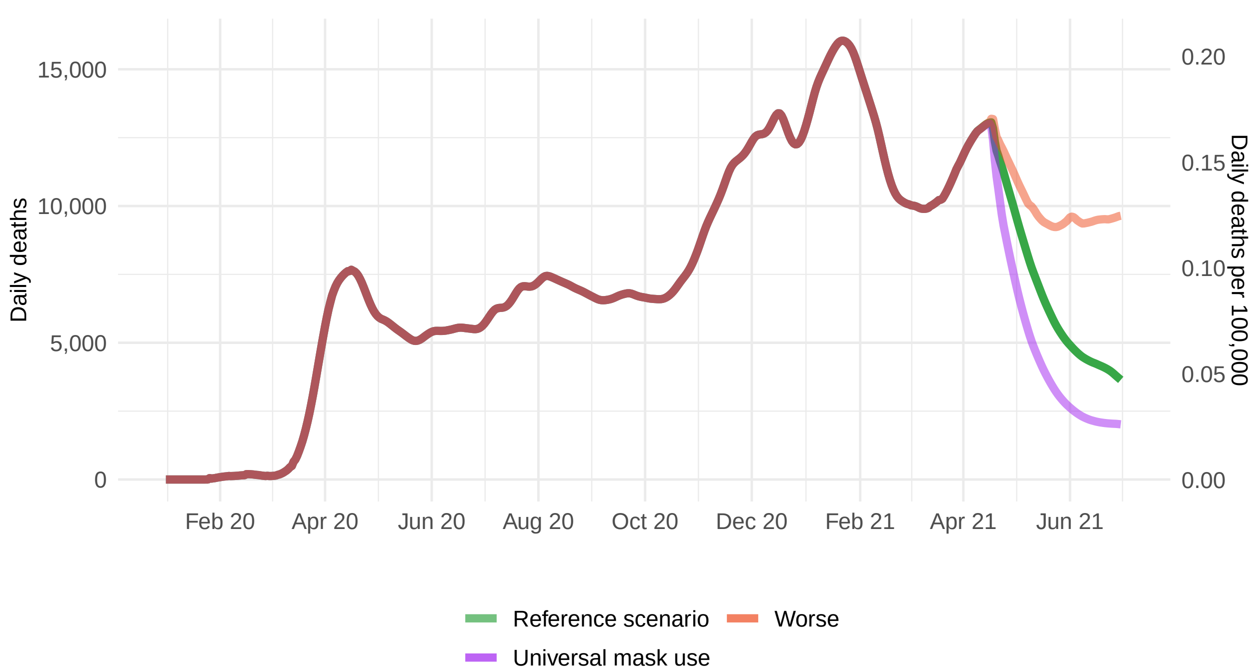
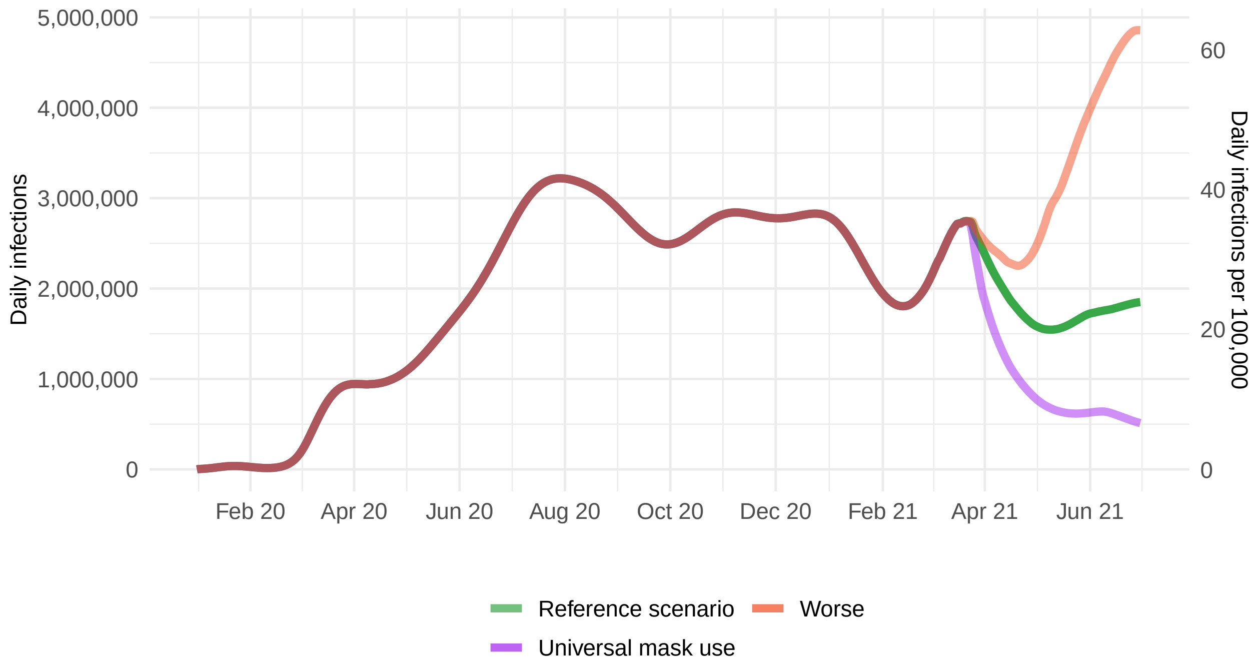


Figure 20. Daily COVID-19 infections until July 01, 2021 for three scenarios.



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.